FORMAL COMPLAINT

ARIZONA CORPORATION COMMISSI(
FORMAL COMPLAINT FORM

APS Docket No. E-01345

COMPLAINT	COMPLAINT NUMBER	DATE
Negligence of Electrical Service	61782	March 30, 2010
ADDRESS		PHONE (HOME)
JALLL LLC, 902 Leisure World, Mesa AZ 85206		602-881-7291
NAME OF RESPONSIBLE PARTY		PHONE (WORK)
Lynn A. Wheeler		602-881-7291
NAME OF UTILITY		ACCOUNT NUMBER
Arizona Public Service Company (APS)		306503283 E-01345A-10-0201

GROUNDS FOR COMPLAINT: (COMPLETE STATEMENT OF THE GROUNDS FOR COMPLAINT INDICATING DATE(S) OF COMMISSION/OMISSION OF ACTS OR THINGS COMPLAINED OF.) (USE ADDITIONAL PAGE IF NECESSARY.)

The heating/air conditioning units at the America's Choice Inn and Suites at Gila Bend, Arizona (hereafter referred to as the Motel) have been irreparably damaged because of low-voltage electrical power provided by Arizona Public Service Company (APS). Seventy-three heating/air conditioning units were damaged beyond repair. APS knew of the problem but refused to take action to correct the low-voltage electrical service until forced to do so by the Arizona Corporation Commission.

The motel was built in 1989. 208-volt electricity was chosen to power the facility. It is the choice of electrical power for the majority of small and mid sized motels and hotels in the United States. 208-volt power is a very popular voltage for a wide number of applications. American Power Conversion has published White Papers #27 "Use of 208 Volt verses 120 Volt Inputs for Servers" and #29 "Rack Powering Options for High Density." Both documents discuss the advantages of 208-volt power in commercial applications using servers which draw greater amounts of power. (Attachments #1 & #2) Pulizzi Engineering, Inc. announced a 208-volt, 30-amp server. The company advises a decrease in current draw by up to 50 percent which allows for greater equipment density by using the 208 volt system. (Attachment #3) Further, an "Associated Content" article talks about the advantages of 208-volt power systems. The author advises, "The 208-volt power supply is also more efficient and can result in power savings. This is because the 208-volt power line consists of two live lines when compared to 110-volt power line that consists of only one in live line." (Attachment #4) Edlen Electric makes the comment, "Most industrial equipment is rated at 208 volts…" (Attachment #5) As an example, Airgas Company is advertising a Miller Spectrum Plasma cutter using 208/230 power. (Attachment #6) It is safe to say, 208-volt electrical power is extremely common and widely used in industrial applications everywhere in the United States.

Air conditioning representatives have advised the motor/compressors on the air conditioning units at the Motel are designed to operate between 208 and 230 volts. (The motor and compressor are combined in these units.) The motor/compressors are name plated 208/230. This is the standard configuration for mid-sized, through-the-wall air conditioners that are manufactured by companies such as Amana, Carrier, Fedders, Friedrich, Frigidaire, GE, Sears and others. Manufacturers make smaller units with 115 volt systems and large units which draw 265 volts. The TRANE Manufacturer has a document titled, "Packaged Terminal Air Conditioners & Heat Pumps" showing they manufacture Packaged Terminal Air Conditioner (PTAC) units with main power supplies of 230-208 volts, 265 volts and 115 volts. (Attachment #7) Fedders Company has a similar document titled, "Packaged Terminal Air conditioners and Heat Pumps" which also shows main power supplies to be 208/230 volts, 115 volts and 265 volts. (Attachment 8) "A. J. Madison, Your Appliance Authority" advertises numerous brand names and models of PTAC units on line with available power of 230/208 volts and 115 volts. (Attachment 9) A thorough research has shown companies do not manufacture through-the-wall PTAC air conditioner and heating units which run at power supplies other than 208/230 volts, 115 volts and 265 volts. <u>PTAC units using 200 volt power supplies are simply not available for purchase.</u>

Advantages of the PTAC are described on the Furnace Compare web site. "One PTAC is installed for each room, and the occupant of each room can control the temperature of that room independently from other rooms. Some PTAC units include an optional heating unit as well." (All units at the motel contain an electric strip or heat pump to provide heat.) Furnace Compare describes the PTAC units as cost effective, "Because PTAC units are typically installed in rooms with a wall leading directly to the outside, they don't require ductwork, which can substantially reduce both installation cost and the amount of space needed for installation." Furnace Compare advises advantages as, "Inexpensive to operate because PTAC Air Conditioners are self-contained units that heat each room individually, you only use the amount of energy that it takes to heat or cool a room unlike other heating systems, such as central heat and air that heat or cool an entire house." (Attachment 10)

All heating/air conditioning units used in the motel were new at the time of motel construction. These units are the standard "through-the-wall," "Packaged Terminal Air Conditioners" (PTAC) units drawing 208/230 volts of electrical power. They were and remain the chosen method of heating and cooling small to mid sized motels and hotels in the hospitality industry. The original heating/air conditioner units, installed at the motel, performed satisfactorily for approximately 11 years. There were routine maintenance problems of bearings needing lubrication or Freon/coolant leaks in the system during the first 11 years of use. However, starting in 2000, we began experiencing PTAC failures because the motor/compressor units were burning up. The deduction at that time was the PTAC units were 11 years old and had probably reached the end of their service life. All 73 heating/air conditioning units at the motel were replaced with new units during the time frame of April 2000 to March 2003.

- 4/10/2000 Purchase 3 Heating/Air Conditioners $ 1,181.48
- 5/09/2000 Purchase 14 Heating/Air Conditioners 7,140.00
- 1/15/2003 Down payment 56 Heating/Air Conditioners 21,000.00
- 3/08/2003 Final payment 56 Heating/Air Conditioners 7,807.00

New air conditioning units have a life expectancy of at least 15 years. However, the new air conditioning units began experiencing the same problems within 6 months to 2.5 years after installation. The motor/compressors were burning up. The motor/compressor units were initially replaced by the manufacturer under warranty conditions. The motel paid for trouble shooting and changing the motor/compressors. Some of the dates and expenses to trouble shoot, make repairs and replace motor/compressors can be found at Attachment #11.

When the first few air conditioning units failed, the thought process was the units had faulty compressors and had burned up because of manufacturing problems. After additional units failed, one of the maintenance technicians (Joe Huffine) recommended checking the power supply. He advised the PTAC units are designed to operate in the power range of 208 to 230 volts. Operation outside of that power range, especially below 208 volts, will damage the motors because of over heating. Continued operation at the low voltage will eventually cause the motors to burn up and fail.

We contacted APS and advised them of the problems we were experiencing. We requested they come in and set up voltage monitoring meters to measure the power levels being supplied to the motel. APS was initially resistant to conducting any measurement. After repeated phone calls, APS finally agreed to comply with the requests. We were able to obtain copies of the results through the Arizona Corporation Commission (ACC). It appears John LaPorta, ACC Investigator, had to request information from APS on four occasions. Each response included more information until finally on the fourth response, all information was provided. There was no explanation provided why APS was so resistant in providing information to the ACC. The information came via fax; an overview of the documents is shown on the following table.

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Fax #	Date	Atch. #	Contents
1	6/30/2006	12	Raw data on three graphs for 6/21/2006 through 6/27/2006
2	7/10/2006	13	Voltage Minute Histogram Report analyzing data from Fax #1
3	7/13/2006	14	Raw data and Histogram of voltage for 6/13/2006 through 6/16/2006
4	7/17/2006	15	Comprehensive data collected for both dates listed in Faxes 1-3 above

The Voltage Minute Histogram Reports reveal the voltage level, minute-by minute for all the time the recorder is connected to the line for the three channels coming into the motel. Additional analysis was conducted manually to determine the amount of time and the percentage of the test time the voltage was below the desired 208 volt minimum, or outside the 208 - 230 volt range. The manual data compilation is shown at Attachment #16. The analyzed information from the four faxes provided by APS to ACC Investigator John Laporta is shown in the following two tables.

Data From 6/13/2006 - 6/16/2006 Test

Channel Number	Total Minutes	Minutes < 208 Volts	Percent < 208 Volts	Comments
1	3999	716	17.9	A significant time below desired 208V minimum
2	3999	2223	55.6	Over half the time below the desired 208V minimum
3	4000	0	0	Perfect result; 100 percent between 208 & 230 volts

Data From 6/21/2006 - 6/27/2006 Test

Channel Number	Total Minutes	Minutes < 208 Volts	Percent < 208 Volts	Comments
1	8585	0	0	Perfect result, 100 percent between 208 & 230 volts
2	8584	2110	24.6	One fourth of the time below desired 208V minimum
3	8584	6105	71.1	Over 70 % of time below the desired 208V minimum

An additional test was later conducted beginning sometime on 8/09/2007 and running through 8/13/2007. A copy of the strip chart is shown at Attachment 17. APS, however, did not provide the Voltage Minute Histogram Report. Subsequently, no numerical data is available to be analyzed. Nevertheless, it is obvious when examining the strip chart, the voltage on Channel 1 is below 208 volts for the majority of the time. The Channel 2 voltage appears to drop below 208 volts for a significant amount of time. The Channel 3 voltage is the best of the three channels, but still drops below 208 volts part of the time. There was no perfect performance during the 2007 test as there was during the 2006 tests.

APS has taken the position they were providing service within 5 percent of the 208-230 electrical service that is needed. Engineers at APS have stated the legal limit is plus or minus 5 percent and it is OK for the voltage to drop to 197.6 volts.

Following this test, we requested APS change the setting of the transformer to allow higher voltage electricity to flow to the property. APS advised us they had no way of raising the power supply to allow a higher voltage. (At a later date during mediation, we found this statement to be untrue.) We hired Jerry Geiger to help resolve the issue. Geiger is a commercial electrician and the owner of Geiger Electric. Geiger advised, if APS would not increase the voltage of the electricity, there were three alternatives that would rectify the problem:

1. Reconfigure the existing electrical circuit breaker panels to increase the service supply leaving the box.
2. Use a step-up transformer below each circuit breaker box to adjust to the proper level needed.

3. Have APS install transformers on the ground with taps which allow the voltage of the power supply to be adjusted to the proper level.

Representatives from APS and the Motel met with a mediator John LaPorta from the Arizona Corporation Commission on August 22, 2007. A copy of the transcript is found at Attachment # 18. During the mediation, Ken Wolfe, Southwest Manager for APS, acknowledged that power less than 208 volts would cause damage to the heating/air conditioner (PTAC) units. If in fact the power supplied is continually below 208 volts, it would result in the destruction of the motors. This information is located on page 7, lines 2 through 23 and again at page 14, lines 33 to 40 of the transcript from the mediation. During the mediation, Chris Weathers, senior engineer from APS, repeated several times, a motor rated 208/230 is not a NEMA standard motor. He implies the 208/230 volt motor/compressor is unusual and rarely used in commercial settings. This information is found on page 8, line 17, page 10, lines 28-29, page 11, line 37 and page 14, line 32. The comments and position taken by Chris Weathers is definitely contrary to the information found on the internet concerning the 208 volt system and the advantages of using it. Two of the significant quotes were: (1) "The 208-volt power supply is also more efficient and can result in power savings." (2) "Most industrial equipment is rated at 208 volts…" The White Papers from American Power Conversion explained at some length the advantages of using 208-volt power for computers. All of this information was related in the second paragraph on the first page of this complaint. See attachments #1 through #6 for detailed information.

Chris Weathers further instructed we should have ordered new replacement air conditioning units with a manufacturing specification of 200 volts. That would have resolved the problem. This information is found on page 9, lines 7 through 18 and again beginning on page 11, line 37 through page 12, line 14 of the mediation transcript. As previously documented above, there are no companies who manufacture PTAC units which use 200 volts. According to Miguel Chinchilla, Manager of the Valley of the Sun Heating & Cooling, Inc., through-the-wall air conditioning, PTAC units are not made to a 200 volt specification. What Chris Weathers proposed as a solution to the problem is in fact not feasible. In an E-mail message from dated January 6, 2009, Chris Weathers concedes this fact with his statement, "Your information may well be correct about no compressors with 200V motors. In the vast majority of application across the USA, there will be no problems with 208V/240V motors." (Attachment #19)

Chris Weathers also recommended two additional solutions to the low voltage electrical power (less than 208 volts) being supplied to the motel: (1) rewire the motel and convert it to a 240 volt system or (2) use a buck boost transformer to raise the voltage back up to the acceptable operating limit between 208 and 230 volts. This information can be found on page 9, lines 11 through 18 of the mediation transcript.

During the mediation, Lynn Wheeler asked the APS representatives, why they couldn't change the taps on the transformers and raise them up to a higher voltage. (page 17, lines 4 and 5) The APS representatives responded, raising the voltage would cause other equipment in the facility to burn out because of too high of voltage on the 120 volt side. They cautioned we would have computers, TVs, light bulbs, refrigerators, etc burning out. (page 19 line 29 to page 20, line 31) Later during the mediation, the transcript shows the APS representatives admits the 120 volt power being supplied to the motel is also on the low side. (page 23, line 21 to page 24, line 14)

APS Engineer Chris Weathers explains motors running at high temperature will cause the insulation to fail, but it will take several years. Lynn Wheeler responds other sources have advised it just depends on how high the temperature gets because of the low voltage and how long of time it runs at the high temperature. (page 25, lines 20-26) Chris Weathers then admits APS has been supplying electrical power that is frequently dropping down to 197 volts and below and remaining there on a steady state basis. (page 25, lines 32 to 41)

Chris Weathers returns to his theme, all APS has to do is remain within plus or minus 5 percent of 208 volts. He insists the problem is the wrong motor was purchased for the PTAC units. Had we talked to APS prior to purchasing the 73 new PTAC units, he would have told us to purchase a 200 volt motor. (page 27, line 5 to page 28, line 3) Lynn Wheeler explains again, through-the-wall PTAC units are not manufactured with 200 volt motors. Chris Weathers and Ken Wolfe respond adamantly, Lynn has been dealing with the wrong supply house and state, "You can order it, with all due respect, yes, you can." (page 28, line 5 to page 29, line 8) As mentioned above, Chris Weathers later acknowledges this is incorrect. In E-mail dated January 6, 2009, Chris Weathers writes, "Your information may well be correct about no compressors with 200V motors. In the vast majority of application across the USA, there will be no problems with 208V/240V motors." (Attachment #19)

Toward the end of the mediation, Chris Weathers and Ken Wolfe admit, APS does in fact have the ability to increase the voltage by increments as low as 2.5 percent. (page 30, lines 17 to 38) Unfortunately, the mediator's recording device ran out of space before the mediation was completed. However, APS did agree to increase the power voltage as requested as long as representatives of the Motel had a qualified electrician on the premises during the time the increase was being performed.

The increase in voltage was finally accomplished on August 30, 2007. Jerry Geiger from Geiger Electric was on scene at the Motel to monitor the change in the power supply. On the first attempt, the APS service technician turned the voltage adjustment in the wrong direction. The voltage was actually decreased. It's a good thing Jerry Geiger was on scene to provide oversight. On the second attempt, the APS service technician increased the voltage supply to 95 percent (Max) setting which raised output voltage approximately 6 volts phase to ground and approximately 10 volts phase to phase. (Attachment #20)

The results of increasing the electric voltage are as follows:

1. There have been no incidents of computers, TVs, light bulbs, refrigerators, etc burning out as a consequence of too high of voltage as predicted by APS representatives.
2. The burn life of light bulbs has dramatically increased. This is especially evident on exterior flood lights which require high-lift bucket trucks to change.
3. Burn out and replacement of cable television modulators has almost completely stopped. Prior to the power increase, we were experiencing burn out and replacement of these units on a quarterly basis.
4. The increase of power has eliminated the overheating of the PTAC units.
5. The motel continues to experience failure of air conditioning units after the voltage adjustment. According to Michael Burgett, President of Electrical Decision, Inc., the long-term operation of the air conditioning units at the low-voltage levels has caused irreversible damage to the units. We can expect the remaining air conditioning units to fail in the near future. The length of time to failure is dependent on how long the PTAC units were run on the low-voltage power. APS Engineer Chris Weathers acknowledges the same facts during the mediation found on page 18, lines 11 to 17 of the transcript. He states, "You know, motors just don't suddenly fail because the voltage is low. What happens is they draw more than rated current. And, typically, as the temperature goes up, that rule of thumb is for every doubling of the...of every 10 degree increase in temperature, the life of the insulation goes down by one-half. So, what could have been happening is that these motors were overloaded five years ago, but it took until now for the insulation system to finally get to the point where if failed. So, this could have been going on right from day one."

Information which has become available since the mediation between APS and America's Choice Inn and Suites, sheds additional light on this situation and helps clarify the cause of the low voltage. The following time line helps show the cause of the irreversible damage and ultimate destruction of 73 PTAC units at the motel.

1. The motel was built in 1989
2. For the first 11 years, we experienced no PTAC unit failures due to overheat and burn out.
3. Electrical power is provided through the Gila Bend #22 feeder. (Attachment #21)
4. The motel is actually close to the very end of the power line that is supplied by Gila Bend #22 Feeder. A truck stop and café are the two final customers on the line. Neither of these business use 208/230 volt, PTAC units.
5. During the period of 1995 through 2008, 86 new Residential and General Service customers were added to the Gila Bend #22 Feeder. (Attachment #21, page 2)
6. In an E-mail message, Angela Allison, APS Senior Consumer Advocate, advises Connie Walczak, ACC Consumer Services Supervisor, of improvements made to Gila Bend #22 Feeder. Allison states, "Prior to Mr. Wheeler's complaint(s), APS records do not indicate any additional improvements other than normal repairs after storms." (Attachment #21)
7. In an E-mail message, Jessica Hobbick at APS advises John LaPorta, ACC Investigator, about the complaint, "I researched Mr. Wheeler's complaint and found that an APS serviceman visited this property on 5/22/06 in response to a report of low voltage. To resolve the problem a capacitor was replaced. This corrects the power factor of a circuit and the voltage improved immediately. Since this seemed to resolve the problem, the serviceman did not feel it was necessary to install the recording volt meter at that time." This statement documents the voltage was increased to a higher setting approximately three weeks before the voltage meters were connected by APS. (Attachment #23)
8. On March 7, 2008, almost seven months after the voltage was turned up at the motel, "APS installed a voltage regulator bank to maintain consistent voltage" on the #22 Feeder. (Attachment #21) When we inquired why the regulator was installed, Angela Allison, APS Senior Consumer Advocate, advised it was for another customer. Allison would not reveal who the other customer was.

In hind sight, it seems obvious what has happened to cause the irreversible damage to the 73 PTAC units. At the time of construction in 1989, the 208-volt electrical system was the choice of power for a number of reasons discussed above. The motel is geographically located at the end of the power line served by the Gila Bend #22 Feeder almost 6 miles away. When the motel was constructed, APS provided electrical power somewhere between 208 and 230 volts; there was ample power for the 208-230-volt PTAC units to operate However, beginning in 1995, 86 additional electrical services were added to the line powered by Gila Bend Feeder #22. The diagram at Attachment #24 shows two time lines juxtaposed to each other to illustrate the increased power drain on Feeder #22 and the PTAC unit failures at the Motel. The Motel was constructed in 1989. APS has not provided any documentation of how many services were added during the five years between 1989 and 1995. However, during the five years between 1995 and 2000, 35 Residential and General Service Customers were added to Feeder #22. (Attachment 21, page 2) APS will not divulge what businesses come under the "General" classification or how much power is required for these "General" customers. The year 2000 is when we replaced the first 17 PTAC units at the Motel. Between 2000 and 2003, 28 additional Residential and General meters were added to Feeder #22. The year 2003 is when we replaced the remaining 56 PTAC units at the motel. During the next five years, before APS increased the electrical power setting, 23 additional Residential and General Service Customers were added to Feeder #22. During the mediation, when Lynn Wheeler asked APS Engineer Chris Weathers, "Why did I start having troubles three years ago?" Chris Weathers responded with a telling answer, "It might have been that our voltage was a little bit higher, just marginally higher 15 years ago, and as Gila Bend grew and whatnot, it came down a little bit." (Attachment 18, page17, lines 33 to 38) By their own admission, "APS records do not indicate any additional improvements other than normal repairs after storms." (Attachment #21) By their own admission, APS reveals "…but of course, the reality is we're dropping down to 197 frequently, and maybe…maybe even a little bit below that. On a steady state basis. I'm not talking about motors starting, causing the voltage to go up and down, I'm saying on a steady state basis." (Attachment 18, page 25, lines 33 to 36) By their own admission, APS increased the voltage before testing the voltage levels. This raises the question, how much lower was the voltage prior to the APS serviceman making his repair? The picture of what has caused the destruction of these 73 PTAC units is alarmingly clear.

At no time did APS provide any notification the voltage of the electrical power they were providing was deteriorating. At no time did APS advise, since the voltage on your electrical service is being allowed to drop, you, the customer, will have to add buck boost transformers to raise the power voltage to keep your equipment from burning out. An internal communication found after mediation shows APS increased the voltage by replacing a capacitor three weeks prior to testing the voltage levels. After testing, the voltage was still found to be outside of the 208-230 volt range. It finally required intercession by the Arizona Corporation Commission through a mediator to get APS to take action and raise the voltage of the electrical power they supply. Had APS been monitoring the electrical power being supplied and making improvements while they added 86 additional services to the line, the result would be different. Some or all of the original PTAC units installed in 1989 could very easily still be operating. Certainly, all of the new replacement PTAC units installed between 2000 and 2003 would still be operating without the irreversible damage they have sustained. APS has the ability to maintain electrical power between 208 and 230 volts as shown by the histogram data of the power on June 13-16 and again on June 21-27, 2006. APS knew they should be providing power between 208 and 230 volts. Ken Wolfe and Chris Weathers freely admit the low-voltage power was causing irreversible damage to the 208-230-volt PTAC units during the mediation. (See previous citations) Two months prior to mediation, Prem Bahl, engineer for the ACC, states the same information in his E-mail to APS employee Jennie Vega on June 19, 2007. (Attachment #22) Prem Bahl starts his E-mail message with, "This follows up my conversation today with Angela Wilson and Ray Passarelli in regards to a complaint of low voltage by Lynn Wheeler of Gila Bend." Angela Wilson and Ray Passarelli are both employees at APS. Prem Bahl continues, "The 73 air conditioners installed at the hotel are designed to operate at 208/230V. Even if the voltage is within permissible limits of +/- 5% variation, it is understood that these air conditioners do not operate efficiently at voltages less than 208V." He gives his recommendation of what to do, "I suggested to Angela that APS may offer to the customer higher voltage supply option, providing him with a cost estimate, for which he would be responsible, and meantime maintain the voltage at the premises at 208V or slightly higher."

This story has similarities to the maiden voyage of the ocean liner Titanic. You can see the events happening that finally result in the ship sinking with hundreds of lives lost. There are no records available which show how many customers were added to Feeder #22 for the first five years after the motel was constructed. There were however, 86 Residential and General (Business) meters added from 1995 through 2008. With each new customer added to Feeder #22, the voltage level of the power being supplied to the motel decreased. As the voltage dropped below 208 volts and remained there for increasing periods of time, the PTAC units failed faster and faster. Even new PTAC units were failing within 6 months of installation. In 2007, APS was finally forced to increase the voltage of the electricity going to the motel to allow operation within the limits of 208-230 volts. Unfortunately, it was after there was irreparable damage done to 73 new PTAC units.

NATURE OF RELIEF SOUGHT: (USE ADDITIONAL PAGE IF NECESSARY)
Direct APS pay for the replacement and installation of 73 through-the-wall PTAC heating and air conditioning units at the America's Choice Inn and Suites at Gila Bend, Arizona.

SIGNATURE OF COMPLAINANT OR ATTORNEY: Lynn A. Wheeler

ELECTRICAL DESIGNS
INCORPORATED

4045 East McDowell Road • Suite B • Phoenix, Arizona 85008 • 800-537-6552 • 602-275-4365 • F 602-275-2110

May 10, 2010

America's Choice Inn and Suites
P.O. Box 51954
Phoenix, Arizona 85076

Attention: Mr. Lynn Wheeler

Re: Arizona Corporation Commission Formal Complaint E-01345

Dear Mr. Wheeler:

As you requested we have reviewed the information given to us pertaining to this complaint. We shall try to address the complaint form rather than all of the supportive data (ie., the transcript of the mediation).

Page 2 of 7 of the complaint, it is noted that Mr. Wheeler felt he had a problem and APS reluctantly checked their supply. According to Mr. Wheeler, the first APS field representative was incapable of putting on the test equipment. The fact that Mr. Wheeler had to get the test results from the Arizona Corporation Commission rather than APS appears to be clandestine or deceptive.

Page 3 of 7 of the complaint, it is stated that APS did not release the histogram report, but a summary of the data.

Page 4 of 7 of the complaint, the APS representatives, Mr. Wolfe and Mr. Weathers, are not professional engineers and therefore may be knowledgeable in electricity at a utility company but are not recognized by the State of Arizona as experts or engineers. Further, contradictory reports and inaccuracies are obvious. Mr. Weathers implies that 208/230 volt motors/compressors are unusual. Nothing could be farther from the truth. In over 30 years of my experience and my associates, we have never seen a 200 volt compressor or motor in any package air conditioning unit. Most are either 208/230 volt or 208

volt, with UL labeling, which is required by the municipalities and the National Electrical Code (110.3.b-....labeled and listed for their use).
Page 4 of 7, Mr. Weathers also indicated a 200 volt compressor needed to be purchased. If a non-technical manager needed a replacement unit to rent a room and all local suppliers had a 208/230 volt unit in stock, the non-technical person would see the electrical panels and service are labeled 208 volts and believe that the unit available would be adequate. How would this non-technical person know or even consider that a 208/230 volt unit would be unacceptable? How would the utility company tell the customer that a standard rated, listed unit, is not acceptable on the voltage system supplied by the utility? Should all customers pay a professional to test their system voltage and purchase special order units each and every time they intend to replace an air conditioning unit? Why would the State of Arizona have a Corporation Commission charged with electricity regulation if that is the case? For Mr. Weathers to insist that America's Choice Inn and Suites should have purchased 200 volt through-the-wall units (special order), a voltage that is not a standard voltage in the APS or SRP power quality books, not listed as standard, not carried as standard, not sold, not readily available by any supplier in the County is ridiculous and appears to be a sham to avoid responsibility.

Mr. Weathers then recommended rewiring the building to a 240 volt system. This feat is nearly impossible without completely demolishing and replacing all of the major distribution of the entire building. The 208 volt system is configured in a wye system with all phases equal to ground and a balanced 120 volt load on all. The 240 volt system is configured in a delta with all of the 120 volt loads on two of the three phases. Therefore, all of the existing wiring would need to be relocated and redistributed and new transformers from APS. This suggestion is ludicrous and would cost hundreds of thousands of dollars with months of lost revenue. It is also impractical from a utility stand point since the utility would not service a building this big with that system voltage.

Page 4 of 7, Mr. Wheeler asked if APS could not tap up the transformer. Earlier, Mr. Wheeler, asked the field representative from APS the same question and the field representative said the transformer did not have that ability. It has been our experience, for example, in 1984, we had an APS customer representative, Mr. Jerry Dillon, tap up a set of pole mounted transformers for the same reason. The field representative Mr. Wheeler spoke with was obviously not familiar with the secondary side of APS distribution equipment. These gentlemen representing APS are experts in utility company distribution, but are not taking into consideration the losses within a building. The National Electrical Code recommends that no more than 5% to the end of line be the maximum voltage loss within a facility. In 1989 and most hotels and motels, the design did not adhere to this request closely. The designs of the buildings were usually minimizing the wire to save construction cost and relying on the fact most motels and hotels were never fully occupied.

On page 5 of 7, Mr. Weathers and Mr. Wolfe indicate that the transformers are adjustable by 2.5%. We have not seen a transformer under 100 kVA which did not have (2) taps (2.5% each) under voltage and (4) taps (2.5% each) over voltage for field adjustment. Again the internal losses of the building would have been sufficient to protect the equipment on the 120 volt distribution.

On page 6 of 7, note 7, indicates that because of Mr. Wheeler's complaint APS replaced a capacitor to fix a low voltage condition. This admission does not tell how long the low voltage condition had been, nor how low the voltage condition was. Therefore, this period of low voltage could have been enough to damage the insulation and shorten the life of the through-the-wall units. In note 8, the indication is that the voltage was so inconsistent that another customer complained and APS put in another device to regulate the voltage. These two years could have contributed to the shortening of the life of the units. Most of America's Choice Inn and Suites load is air conditioning.

No matter how much smoke APS puts up to screen the truth, the obvious fact is, for eleven years the Gila Bend Feeder #22 was lightly loaded and supplied the correct voltage to America's Choice Inn and Suites. As the feeder became loaded during the next few years, APS did not maintain the feeder and voltage and only up-graded the feeder when customers complained and allowed the system to supply sub standard power to its customers. This blatant disregard of their customers has caused America's Choice Inn and Suites to spend an inordinate amount of money to maintain their facility.

It is our opinion that America's Choice Inn and Suites has been improperly serviced by the utility and that the emphasis the utility placed on the units is an attempt to throw the blame on the customer rather than to admit to their negligence in maintaining a proper system. Further, the Arizona Corporation Commission should, in our opinion, do what they were created to do by protecting the customer from this type of manipulation by utilities and semi-monopolies. We have called the Arizona Corporation Commission to get their rules and regulations, only to be sent directly to the utility company. This does not make sense. We do not want to get information from the fox in the henhouse about the rules of the henhouse.

If you have any questions or need additional information, please call upon our office.

Sincerely,

Michael R. Burgett, P.E.
C.E.O.

Registered Professional Engineer (Electrical)
CERTIFICATE NO.
15627
MICHAEL R.
BURGETT
Date Signed 3-17-2012
ARIZONA U.S.A.
Exp 3-31-1?

Use of 208 Volt verses 120 Volt Inputs for Servers

White Paper #27

APC
Legendary Reliability™

Revision 1

ATCH #1

Executive Summary

This note explores the voltage connection options of 208 Volt (V) and 120V for servers in North America. This same discussion applies to the use of 200V vs. 100V in Japan.

Introduction

This white paper explains why and when 208V is used instead of 120V for servers in North America. This same discussion applies to the use of 200V vs. 100V in Japan.

Background

Most entry level and mid-range servers for office use are configured and shipped with 120V plugs but are *designed to accept any voltage worldwide, including 120V and 208V.* Larger pedestal servers and rack-mount servers tend to be configured with 208V plugs.

There are fundamental reasons why one voltage is sometimes preferred over the other. The reasons are explained in the following sections

Why 120V?

Convenience is the overwhelming reason to use 120V and why virtually all small and departmental servers are installed with 120V plugs. Electrical codes require that habitable space be wired with 120V receptacles with a receptacle for every 10 feet of exposed wall. Therefore, 120V is virtually always available at any office site. **However, typical 120V building wiring has a serious and fundamental limitation: the majority of wall receptacles are rated at 15 Amps (15A) and a growing number rated at 20 Amps (20A).**

The 15A rating of 120V office power is very important and a significant limitation. **Underwriters Laboratory (UL) specifies that a single piece of electronic equipment is not permitted to draw more than 80% of a receptacle's rating, or 12 Amps for a 15A circuit. This places a limit of about 1440 Volt-Amps (Volts x Amps) on a standard 15A receptacle.**

Most new servers have power factor corrected supplies with nearly a 1 to 1 correlation to Volt Amps and Watts. This puts the maximum corresponding Watts available through a receptacle also at 1440 Watts - which is the maximum power that a server can draw from a single 15A plug. Due to the losses of the Server power supply, this corresponds to about 1250 Watts of power supply output rating in the server.

Therefore, the maximum power supply configuration typically seen for a server operating from 120V with a single 15A power plug is a server with a 1250W power supply system. Services with a rating of 20A 120V are becoming more popular in commercial environments. For 20A 120V service, 16A or 1920 Volt-Amps or Watts is the maximum of power supply output rating in the server due to losses.

Server power supplies can offer redundancy based on adding additional power supplies. Multiple power cords are also used for redundancy. When a server has 2 power cords, each power cord and power supply must be sized to support the entire server.

It is possible to wire special 120V receptacles for 30 Amp service, but this is very unusual and requires very large wire. Therefore, it is impractical and typically not used for large servers.

It should be noted that a server configured for the maximum power draw described above would use the entire capacity of the 120V circuit. If additional devices like a monitor, PC, Backup device, or RAID subsystem were required then the user would need to supply these from a second circuit which in many cases may require that an additional wire be installed from the AC power distribution panel.

Why 208V?

Power Capacity is the primary reason to use 208V and why many enterprise servers are designed to accept 208V. The most common ratings for 208V receptacles are 20 Amp and 30 Amp, corresponding to about 3600 and 5400 Watts, respectively, of power supply output rating in a server. There very few servers made that require power greater than this level but large enterprise class severs do; for these servers the input power is either hard-wired or multiple 30A 208V cords are provided.

Based on the previous discussion regarding 120V, any server that draws more than the power supply output level of 1920W(20A 120V service), will naturally need to use 208V. Therefore, users should expect this and understand that the use of the higher voltage is driven by fundamental electrical principles.

In addition to the fundamental need to use 208V at higher power, there are other practical reasons why 208V is advantageous.

Rack systems frequently combine a heterogeneous mix of equipment. It happens to be the case that typical rack configurations draw in the range of 1600 to 5000 Watts. This is a poor match to the 120V limitation of 1440W available, but an excellent match to 208V service at either 20Amps or 30Amps. Therefore a single power connection per rack is all that is required at 208V where as many as three connections might be required at 120V.

A given server will draw less current at 208V than at 120V. Therefore its wiring devices, fusing, and switches will run cooler which will reduce their long-term risk of degradation or failure.

An advantage of using 208V is that usually each 208V wall receptacle has its own circuit breaker. This means that the malfunction of a different load cannot trip the server's breaker. In 120V installation, it is very common for a number of receptacles to be fed from a single breaker. This means that in a 120V installation there are often a number of unexpected points where an overload can trip the server's breaker. Most MIS professionals have heard of a case where cleaning personnel have tripped the breaker feeding critical computer loads.

Another advantage of 208V is that the common power receptacles are locking using the twist-lock type plug, which reduces the chance of dislodging them. Furthermore, the quality of the contacts in 208V receptacles is generally higher than 120V receptacles, which greatly reduces the chance of intermittent connections.

What is 240V?

In residential installations in North America and in some limited business installations, 240V is available instead of 208V. Virtually all equipment that operates from single-phase 208V will also operate from 240V. All of the same advantages relative to 120V apply.

What about 3-phase?

Very few servers today require 3-phase power. There is no fundamental advantage to 3-phase for IT equipment, and there are many sites, which simply do not have 3-phase power available. Also, the 3-phase voltage in the rest of the world is much different than that in the USA, making it more difficult to design global products. However, both 120V and 208V single phase can be easily derived from North American 3-phase voltage by simple wire connections; 120V single phase is just the voltage from one of the three phases to neutral, while 208V single phase is the voltage between two of the three phases.

UPS systems for 208V

Users must take the server operating voltage into account when selecting a UPS. There are no "universal" UPS that operate with *all* combinations of voltage. *There are basically four voltage options:*

Facility Voltage (UPS Input)	Equipment Voltage (UPS Output)	Example UPS (www.apcc.com)	UPS Power Range
120V	120V	Smart-UPS	420VA - 3000VA
208V	208V (with 400VA of 120V for aux equipment)	Smart-UPS "T" Series	2200VA - 5000VA
208V	208V, 120V	Symmetra, Matrix	3000VA - 16 kVA
208V 3-phase	208V 3-phase, 208V, 120V	Silcon	10 kVA - 2,000 kVA

For servers requiring 208V, the appropriate UPS is selected based on the level of power required. Where multiple product lines provide the power level required, the choice can be based on product features.

Conclusion

208 Volts offers various technical advantages and is the only choice for higher power servers to be pluggable into standard NEMA outlets. Technically, 208V is a superior choice for powering computing equipment when compared with 120V due to lower current draw. However the ubiquitous nature of 120V wiring in North America and 100V in Japan make these lower voltages preferred by users. This has given rise to the situation where lower powered small business or departmental servers are powered by 120V, while larger and enterprise class servers are powered by 208V.

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Rack Powering Options for High Density

By Neil Rasmussen

White Paper #29

APC
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Revision 5

ATCH # 2

Executive Summary

Alternatives for providing electrical power to high density racks in data centers and network rooms are explained and compared. Issues addressed include quantity of feeds, single-phase vs. three-phase, number and location of circuit breakers, overload, selection of plug types, selection of voltage, redundancy, and loss of redundancy. The need for the rack power system to adapt to changing requirements is identified and quantified. Guidelines are defined for rack power systems that can reliably deliver power to high density loads while adapting to changing needs.

Introduction

Information technology (IT) refreshes in the data center and network room typically occur every 2 to 3 years. As equipment is changed, the power requirement, the voltage requirement, the redundancy requirement, and the connector requirement often change as well. As rack enclosures have become the standard means for housing and organizing computing and communication systems, the power distribution system for the rack enclosure must adapt to these changing requirements.

Power density predictions for racks in data centers have sharply escalated as a result of the high power density of the latest generations of computing equipment. Off-the-shelf IT equipment such as 1-U servers or blade servers can draw 20 kW or more in a fully populated rack. This density cannot be supported in a data center environment where the average rack is fed by a single 120V 20A power circuit. Twenty of these circuits would be required per-rack to support a 20 kW load in a dual-path electrical environment.

The power requirements of modern computing equipment vary as a function of time depending on the computational load. Until the year 2000, this variation was very small and could be ignored for almost all computing and communication systems. However, the implementation of power management technologies into processors and servers began during the year 2000; today the fraction of computing equipment which has a substantial variation in power consumption in response to the computing load is increasing. This variation can be as high as 200% of the baseline power consumption of the equipment. The power distribution system design for a rack enclosure must comprehend this variation.

This paper is focused on AC rack power distribution. DC power distribution has a very limited role in the modern high density data center, as explained in APC White Paper #63, "AC vs. DC for Data Centers and Network Rooms."

This paper is limited to a discussion of North American voltage and connector standards. The appropriate rack power distribution strategy is considerably different for the 230V systems, which predominate in most of the world.

Historic means for providing rack power

The most common approach today is to design, engineer, and install power solutions specific to a rack enclosure. Should the requirements for that rack enclosure change, an alternative power solution must be designed, engineered, and installed. While this approach can comprehend any unique power requirement, it involves significant planning, engineering, and rewiring. Rack enclosures are usually fed from a common power distribution panel within the data center or network room. In many instances, this panel cannot be de-energized in order to adapt a rack enclosure(s) power distribution system (i.e. install another breaker). The result is known as "hot work" and not only introduces a very serious safety hazard, but a high degree of risk of creating a fault in the circuit being worked on and / or dislodging / faulting adjacent wiring circuits. Such errors result in undesirable downtime.

Ideally, the rack enclosure power system would be adaptable to any realistically possible combination of equipment, on demand, without the need to perform any work that would be a hazard to safety or that might adversely affect system availability.

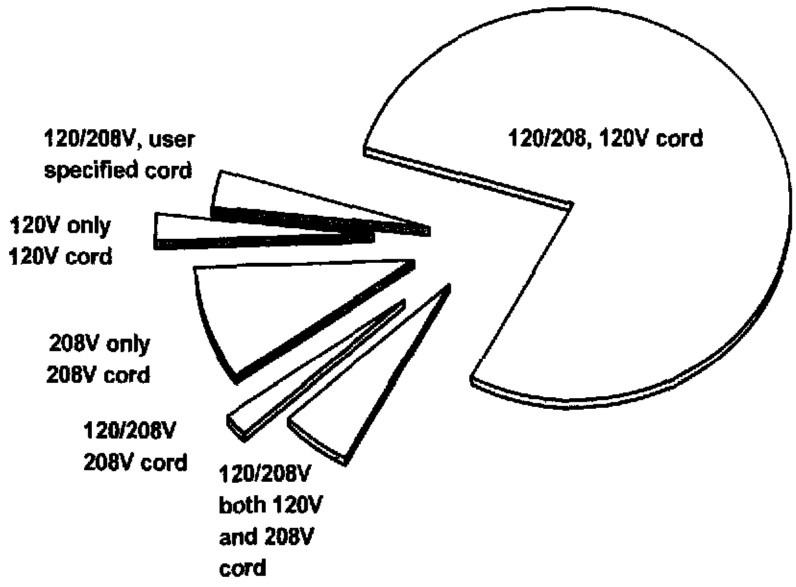
Rack powering requirements

The various dimensions of rack enclosure power requirements are summarized in the following sections. The nature of the requirements is outlined and rational design approaches are summarized.

Voltage requirements

In North America, data centers are provided with both 120V and 208V power. The voltage requirement and supplied power cord of the IT equipment break down approximately as follows:

Figure 1 *– Voltage requirement and supplied power cord for IT equipment in North America*



This complex situation suggests the need for the rack power distribution system to provide both 120V and 208V. However, it is possible to consider using a system restricted to a single voltage, either 120V or 208V. These two possibilities are discussed below.

The selection of 120V as a single voltage standard for a data center seems most convenient because almost 95% of equipment is provided with a 120V power cord. [redacted] accepts only 208V is often the most important and mission critical equipment, such as large routers and blade servers. **Therefore, it is not realistic to design a rack power distribution system based solely on 120V except for very small network rooms.**

[redacted] However, the supplied 120V power cords of the majority of the equipment must be replaced by the user with the appropriate 208V cord, requiring that the user keep appropriate replacement cords on-hand. For some equipment it is also necessary to switch the power supply from 120V to 208V operation with a selector switch; the failure to activate this switch on equipment so-equipped can lead to catastrophic failure when powered by 208V. The 3% of equipment that only operates from 120V can be excluded from the data center, because in almost all cases these devices are small accessory equipment that has acceptable and readily available substitutes that will operate on 208V. Nevertheless, providing 120V in the rack power system can be a very significant convenience, eliminating many plug incompatibilities. For this reason nearly all existing data centers in North America provide both 120V and 208V and virtually none have standardized on 208V exclusively.

[redacted] (Some brands of blade servers being notable examples). Occasionally, a pre-configured OEM rack enclosure is wired using an internal power distribution unit (PDU) that takes in three-phase power and provides three branches of single-phase power to the single-phase IT loads. It is important to note that these IT loads are actually single-phase. Despite the absence of three-phase loads, there is a good case to be made that three-phase power should be distributed to racks as will be shown later in this paper. [redacted]

Power requirements

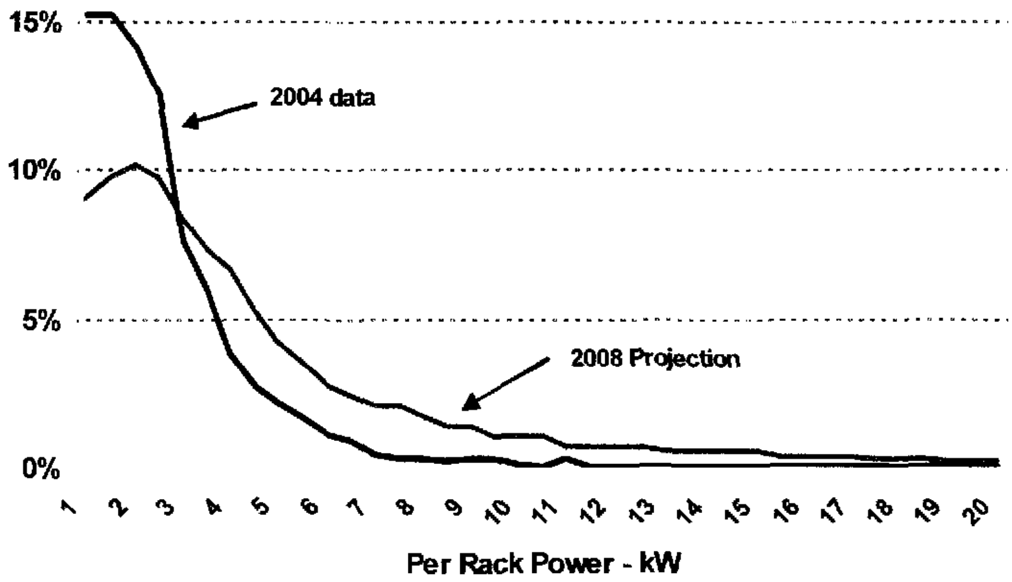
Power densities within the rack enclosure can vary greatly dependent upon the equipment installed. In the extreme low load case, a rack enclosure may only have passive patch panels or a few internetworking switches with a power draw of <100 W. In the extreme high load case, a rack enclosure may be completely filled with high-density servers for a total load of 20 kW or more.

In addition to supplying the total rack power requirement, the rack power system must also be able to provide the required power to an individual device. Sending multiple branch circuits to a rack may appear to provide the total power requirement, but the power requirement of an individual large load may exceed the capability of any of the branches. For example, sending any number of 20 A branch circuits to a rack where a single piece of equipment requires 30 A is insufficient. Another example is a blade chassis with a 30 A plug that may be initially populated with only a few blades and use 5 A on a 30 A circuit. Some users may think they can put multiple blade chassis' on a single 30 A circuit, but as they populate the chassis they overload the circuit. In cases like these, it is recommended that only one load device be attached to each branch circuit.

The appropriate design value for average rack power level is a subject of considerable controversy. An APC survey of usage patterns in corporate data centers, network rooms, and communication rooms for the year 2004 identified the distribution of per-rack power consumption shown in **Figure 2**. This graph shows the frequency of occurrence of racks configured to different power levels. The frequency of occurrence goes down with increasing power level. 95% of racks draw power below 6.5 kW.

A projection of usage in the year 2008 (based on technology / client trends) is also shown in **Figure 2**. This indicates that the average power per rack is increasing over time. It is possible to configure IT equipment today that would exceed a 20 kW per-rack power requirement if fully populated into a rack enclosure. While possible to achieve, we did not find this occurrence to be frequent in real-world installations. The data collected indicates that the average power density per rack enclosure will rise significantly. However, power densities >6 kW will still remain a small fraction of the installed base.

***Figure 2** – Per-rack power consumption frequency distribution*



An analysis of the underlying data of the distribution of rack power indicates the following:

- The very low loads are mainly rack enclosures with wiring patch panels, switches, and hubs
- Loads in the 1 kW range are mainly sparsely populated rack enclosures
- Loads in the 2-3 kW range are mainly rack enclosures that are populated with typical equipment but with significant unfilled rack space
- Loads in the 5 kW range are partially loaded with 1U servers, or contain a mix of technologies
- Loads in the 7 kW + range are extremely rare but, according to customers, are going to become more common with the recent density increases resulting from server technology advancements

Military

Industry News

NEWS

Pulizzi Engineering, Inc. Announces 208 Volt 30 Amp Current Metered Power Distribution Series

3 years 3 months ago

Santa Ana, CA Pulizzi Engineering, Inc. announces the release of the new T982F3 Series rack mount power distribution unit (PDU) with current monitoring. This new series is configured for 208 volt 30 amp power input, making it ideal for today's power hungry applications. Using a 208 volt input is recognized as a more efficient way to distribute power in a data center or in high density electronic enclosures. **When operating equipment at 208 volt versus 120 volt, it decreases current draw by up to 50%, allowing for greater equipment density.** The PDU can power up to (12) devices with power output delivered via industry standard IEC 60320 type C13 receptacles. This receptacle type is often referred to as "computer type" or "high voltage". The front panel of the T982 has an ultra-bright two-digit current meter display that can be read from up to 20 feet away. The current meter allows for greater equipment density by continuously measuring the total current draw of all connected devices. This prevents system overload problems and makes load monitoring easy.

The T982F3 is part of a Pulizzi "Design Your Own" part number series. This innovative part numbering system allows the user to configure and purchase only the options they need. Configurable options include power cable len

ATCH #3

Is a 208 Volt Power Supply Better for Data Centers?

By **Bobby Farell**

If you manage a data center, then you should pay great attention to the power requirements of your server equipment. Since the businesses nowadays are dealing with increasing amount of data and applications, the number of server equipments required in a data center is required has increased manifold. The server racks have certainly helped to pack the equipment tightly in the server room but the tight density has led to another problem. Nowadays there are increasing cases of the 110 Volts circuits getting overloaded and thus requiring additional circuits or server racks. You can prevent the problems of overloading circuits by switching to 208 Volts power supply instead of a North American standard off 110 Volts. Since most of the server equipment is manufactured for universal power supplies, they recognize the *input voltage automatically and work correctly* even with a high voltage power supply. Plus there are several advantages of using a 208 V power supply that are described below.

First of all, the 208 V power supply allows you to connect nearly double the number of equipment to a circuit when compared to the 110 V power supply. This results in an in instant improvement in your server equipment capacity. **The 208 voltage power supply can also reduce your power consumption thereby leading to significant savings in your power tariff.** This makes it a very important consideration that every small and medium sized business must take into account when they are establishing their data centers.

When you have a 208 V power supply, it will allow you to operate your data center with less number of power whips under the floor when you have raised floor environment. The fewer power whips you have, the fewer circuits you need to manage and thus it will reduce the clutter below the floor. This will also improve the airflow which directly results in lesser cost of cooling. The improved airflow also improves the life of your server and air conditioning equipment.

The 208 V power supply is also more efficient and can result in power savings. This is because the 208 V power line consists of two live lines when compared to 110 V power line that consists of only one in live line. The 2 phase power supply allows you to run your data center efficiently with less power consumption.

The high voltage power supply may not always be a feasible option due to the type of environment you have and whether you have the budget to retrofit your entire data center with the 208 V power. However you must consider the benefits of 208 V power supply before you make any decision. Using the high voltage power supply results in an power saving, improved cooling and ventilation and better server rack density. Plus you save a lot of money in power bills, maintenance and repairs of server and air conditioning equipment. All this definitely makes the 208 V power supply an attractive proposition.

ATCH #4

EDLEN
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Exhibitor Services

Equipment Requiring 208-Volt Power

Equipment requiring high voltage power will range from heavy machinery and medical devices to industrial cooking equipment. Most industrial equipment is rated at 208 volts, but other typical voltages include 220, 230 & 480 volt.

The ratings placed on the equipment will indicate **VOLTAGE, AMPERAGE** and **PHASING**. All three ratings are required to order the correct service.

Example rating stamp for Industrial Pizza Oven

208V 60A 3Ph

This rating indicates the equipment runs on 60 amps of 208-volt three-phase power.

208 VOLT THREE PHASE

5 AMPS			255.00	383.00	
10 AMPS			337.00	506.00	
15 AMPS			388.00	582.00	
20 AMPS			465.00	729.00	
30 AMPS			580.00	870.00	
60 AMPS			759.00	1139.00	
100 AMPS			999.00	1499.00	

Example rating stamp for Technical Medical Equipment

220V 20A 1Ph

This rating indicates the equipment runs on 20 amps of 220-volt single-phase power.

208 VOLT SINGLE PHASE

5 AMPS			170.00	255.00	
10 AMPS			254.00	381.00	
15 AMPS			291.00	437.00	
20 AMPS			364.00	546.00	
30 AMPS			434.00	651.00	
60 AMPS			570.00	855.00	
100 AMPS			750.00	1125.00	

EDLEN ELECTRICAL EXHIBITION SERVICES
CORPORATE INFORMATIONAL RELEASE

ATCH #5

ELECTRICAL EXHIBITION SERVICES

Exhibitor Services

Make sure to order a separate outlet for each piece of equipment. Each piece of equipment requires a separate outlet.

Equipment Requiring 220 to 240 Volt Power

If your equipment requires a higher voltage *such as 220 or 230 volt, place your* order as follows:

1. Using the 208-volt single phase or three phase sections of the order form, complete the quantity field and total cost column.
2. Write in the actual voltage requirement in the blank area next to the outlet ordered.
3. Just below the 208 volt three phase section of our order form there is an area that allows you to order a transformer to boost your power from 208-volt to approximately 220 or 230 volt. Multiply your amperage ordered by the "per amp" charged noted on the order form. Please note, there is a minimum 20-amp charge.

Always check with one of your technicians before placing your order for 220-volt or 230-volt power. You may find that your equipment can run temporarily on 208-volt power, thus *eliminating the need for a transformer.*

Equipment Requiring 380 to 480 Volt Power

If you equipment requires 380 volt thru 480 volt power and those services are not listed on the order form, please contact the phone number provided on our order form or call 800-553-3536 for more information. The cost of 480 volt services is available if ordered on-line. Exhibitors requiring 380 Volt power must contact the Edlen office producing the event for additional order information.

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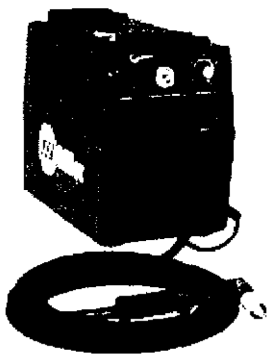
Miller

Miller® Spectrum® 625 Plasma System 208/230 Volt, 1 Phase With ICE-40C Torch And 25' Leads (Liquidation Sale - While Supplies Last)



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Online Orders Only, While Supplies Last – Liquidation of floor models and out of box equipment. Pricing does not apply to new equipment. Availability subject to change without notice – All Warranties Apply – email inquiries to online.orders@airgas.com

A portable plasma arc cutter that can produce a 5/8 inch quality cut, the Spectrum 625 has loads of features that make your cutting needs a breeze. The Spectrum's ICE-40C torch is ergonomically designed to increase comfort, and the safety trigger prevents accidental starts. Pilot Arc Controller improves tip life and maintains uninterrupted cutting.

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ATCH #6

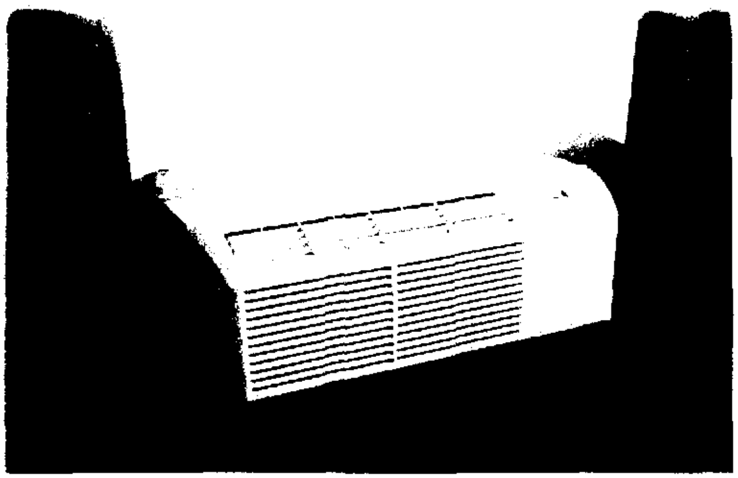
Introduction

Packaged Terminal Air Conditioners & Heat Pumps

Trane Packaged Terminal Air Conditioners (PTACs) and heat pumps are ideally suited for offices, apartments, hotels, motels, dormitories and nursing homes. Key benefits which make the units a wise choice are:

Quieter equipment than ever with Sound Transmission Criteria STC of 27 and NC of 38.

- Exclusive patent pending De-Humidification Control provides up to 30% more moisture removal.
- Flexible digital Interface provides *wall or unit mounted control* adjustment. Wall mounted Interface uses 2 unpolarized wires for connection.
- Plug and Play display means on demand commissioning algorithm and automatic start-up delay.
- The Universal Heater as a standard option means "Everything is stocked and ready to ship."
- Defrost Control – All units are equipped with heat pump control algorithm that prevents freezing of the condenser, while optimizing comfort.



Model Number Description

Each Packaged Terminal Air Conditioner/Heat Pump is assigned a multiple-character alphanumeric model number that precisely identifies each unit.

An explanation of the identification code that appears on the unit nameplate is shown below.

The model number helps owner/ operator, installing contractors, and service technicians to define the operation, components and options for a specific unit.

Refer to the model number printed on the equipment nameplate when ordering replacement parts or requesting service.

P	T	E	E	0	9	0	1	*	A	A
1	2	3	4	5	6	7	8	9	10	11

Digits 1, 2 – Packaged Terminal Air Conditioner

Digit 3 – Product Type

E = Air Conditioner with auxiliary heat

H = Heat Pump

Digit 4 – Development Sequence

E = Fifth Development series

Digit 5, 6, 7 – Unit Cooling Capacity

070 = 7,000 Btu

090 = 9,000 Btu

120 = 12,000 Btu

150 = 15,000 Btu

Digit 8 — Main Power Supply

1 = 230-208V/60Hz/1phase

2 = 265V/60Hz/1phase

4 = 115V/60Hz/1phase (Hydronic Only)

Digit 9 – Electric Heat Capacity*

U = Universal heater (heater kW determined by power cord, see Accessories section)

W = Hydronic (ships with no front cover & no electric heater)

Digit 10 – Miscellaneous

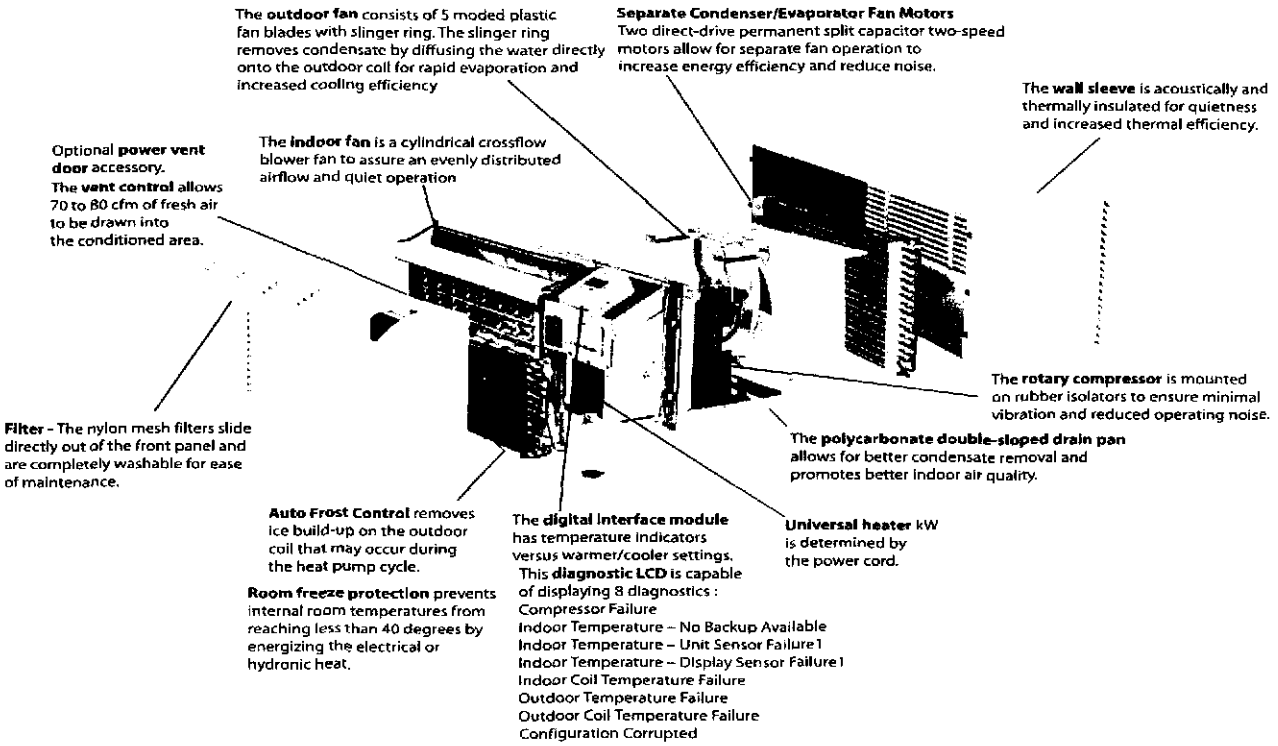
A = Standard

C = Corrosion Resistant

D = Internal Condensate Pump

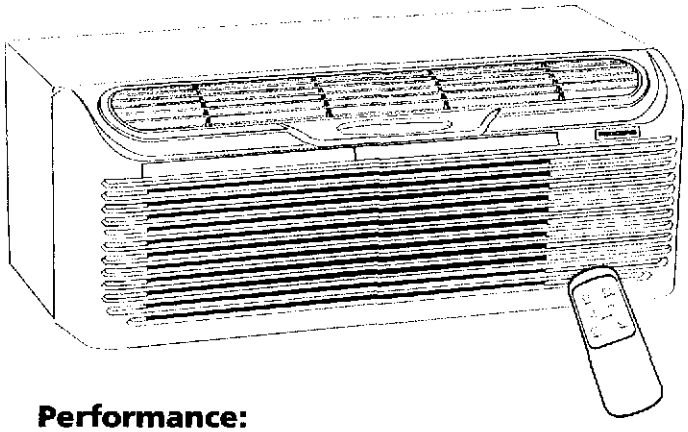
Digit 11 – Minor Design Sequence

Digit 12 – Service Digit



PTAC/PTHP

Packaged Terminal Air Conditioners and Heat Pumps



Fedders Packaged Terminal Air Conditioners are designed to fit all 16" H x 42" W wall sleeves. They are the ideal solution for hotels/motels, apartments/condos, assisted living facilities, schools/dormitories, office buildings, residential additions, suites, modular buildings and medical facilities.

Performance:

Efficiency ratings up to 11.1 EER / 3.3 COP

Cooling capacities from 7,500 to 14,600 BTUH

Heating capacities from 6,900 to 14,100 BTUH

208/230 Volt models

Quiet and Reliable Operation:

Two fan motors for quiet operation and improved performance

Tangential blower wheel for quiet operation

Sound reducing compressor blanket

Fully insulated bulkhead to prevent outdoor sound transmission

Installation Flexibility:

Universal electric heater for various applications

Reversible 2-way directional discharge grilles

Industry standard 16" x 42" replacement chassis fits competitive sleeves

Features:

Adaptable style with industry first, center-mounted touch pad controls with digital display and infra red, hand held remote for easy access

Electronic controls for greater accuracy and reliability

Easy to clean slide out filters

Multi-speed fan settings

Built in self diagnostics

Remote thermostat compatible

Full line of owner defined controls

Central desk control compatible

Fresh air damper allows management of ventilation requirements

Warranty

1–Year parts and labor

5–Year compressor warranty

c UL us

ATCH # 8

SPECIFICATIONS

COOLING / ELECTRIC HEAT PERFORMANCE AND ELECTRICAL DATA

	A6PTAC07UW7A		A6PTAC09UW7A		A6PTAC12UW7A		A6PTAC15UW7A	
VOLTAGE	208 / 230		208 / 230		208 / 230		208 / 230	
NOMINAL CAPACITY	7K		9K		12K		15K	
PERFORMANCE DATA 208 - 230V								
Cooling BTUH	7,500	7,500	8.900	9.000	11,900	12,000	14,200	14,600
EER	11.1		10.6		10.0		9.4	
Heating BTUH	— —	— —	— —	— —	— —	— —	— —	— —
COP	— —	— —	— —	— —	— —	— —	— —	— —
Dehumidification Pts/Hr	1.2	1.2	1.6	1.8	3.0	3.2	3.8	4.0
Sensible Heat Ratio	80%	80%	70%	75%	69%	70%	69%	70%
R-22 Charge (ounces)	23		31.5		24.5		32.5	
ELECTRICAL DATA								
Voltage Range / Min, Max	197 / 253		197 / 253		197 / 253		197 / 253	
Amps	3.4	3.3	4.2	3.8	5.9	5.4	7.6	7.0
Watts	675	675	840	850	1190	1200	1510	1560
AIRFLOW DATA								
Sound dB(A)	47.5		52		51.0		53	
CFM, Indoor Fan High	265	300	300	320	330	340	330	340
CFM. Indoor Fan Low	260	270	260	270	270	280	270	280
Vent CFM	65	65	65	65	70	70	70	70
PHYSICAL DATA								
Dimensions	16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D	
Net / Shipping Weight (lbs.)	106 / 120		96 / 110		110 / 124		118 / 132	

COOLING / HEAT PUMP / ELECTRIC HEAT PERFORMANCE AND ELECTRICAL DATA

	A6PTHP07UW7A		A6PTHP09UW7A		A6PTHP12UW7A		A6PTHP15UW7A	
VOLTAGE	208 / 230		208 / 230		208 / 230		208 / 230	
NOMINAL CAPACITY	7K		9K		12K		15K	
PERFORMANCE DATA	208	230	208	230	208	230	208	230
Cooling BTUH	7,500	7,500	8,600	8,700	11,900	12,000	14,000	14,600
EER	11.1		10.5		10.0		8.6 / 9.2	
Heating BTUH	6,900	7,000	8,200 / 8,400		10,700 / 10,900		13,500	14,100
COP	3.3	3.3	3.2	3.2	3.2	3.1	2.9	2.9
Dehumidification Pts/Hr	1.1	0.8	1.6	1.8	3.0	3.2	3.8	4.0
Sensible Heat Ratio	80%	85%	78%	80%	72%	75%	64%	68%
R-22 Charge (ounces)	28		32		35.0		39	
ELECTRICAL DATA								
Voltage Range / Min, Max	197/253		197/253		197/253		197/253	
Amps	3.4	3.3	4.1	3.9	6.0	5.5	7.9	7.2
Watts	675	675	820	830	1190	1200	1630	1590
AIRFLOW DATA								
Sound dB(A)	47.5		49.5		51.0		53.0	
CFM, Indoor Fan High	265	300	300	320	330	340	330	340
CFM. Indoor Fan Low	TBD	TBD	260	270	270	280	270	280
Vent CFM	65	65	65	65	70	70	70	70
PHYSICAL DATA								
Dimensions	16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D		16 H x 42 W x 13 3/4 D	
Net / Shipping Weight (lbs.)	94/108		110/124		111/125		121/135	

HEATER SELECTION, POWER CORDS & SUB-BASES

UNIVERSAL HEATER TABLE						
kW[1]	HEATER DESIGNATION	VOLTAGES	BTUH	WATTS	HEATER AMPS	MINIMUM AMPACITY
1.98 / 2.45	2	208/230	6,780 / 8,600	1,985 / 2,450	9.5 / 10.6	15
2.82 / 3.45	3	208/230	9,600 / 11,700	2,820 / 3,450	13.6 / 15.0	20
4.09 / 5.00	5	208/230	13,950 / 17,050	4,090 / 5,000	19.7 / 21.7	30

[1] 5kW heater is not available for the 7K or 9K models.

LCDI POWER CORD KITS			
208/230V	APC011A	APC012A	APC013A
Heater kW	1.98 / 2.45	2.82 / 3.45	4.09 / 5.00
Watts	1985 / 2450	2820 / 3450	4090 / 5000
BTUH	6780 / 8370	9600 / 11,700	13,950 / 17,050
Amps	9.5 / 10.6	13.6 / 15.0	19.7 / 21.7
Min. Circuit Amps	15	20	30
Recommended Protective Device	15 amp time delay fuse or breaker	20 amp time delay fuse or breaker	30 amp time delay fuse or breaker

RECEPTACLES


230/208 Volt 15 Amp

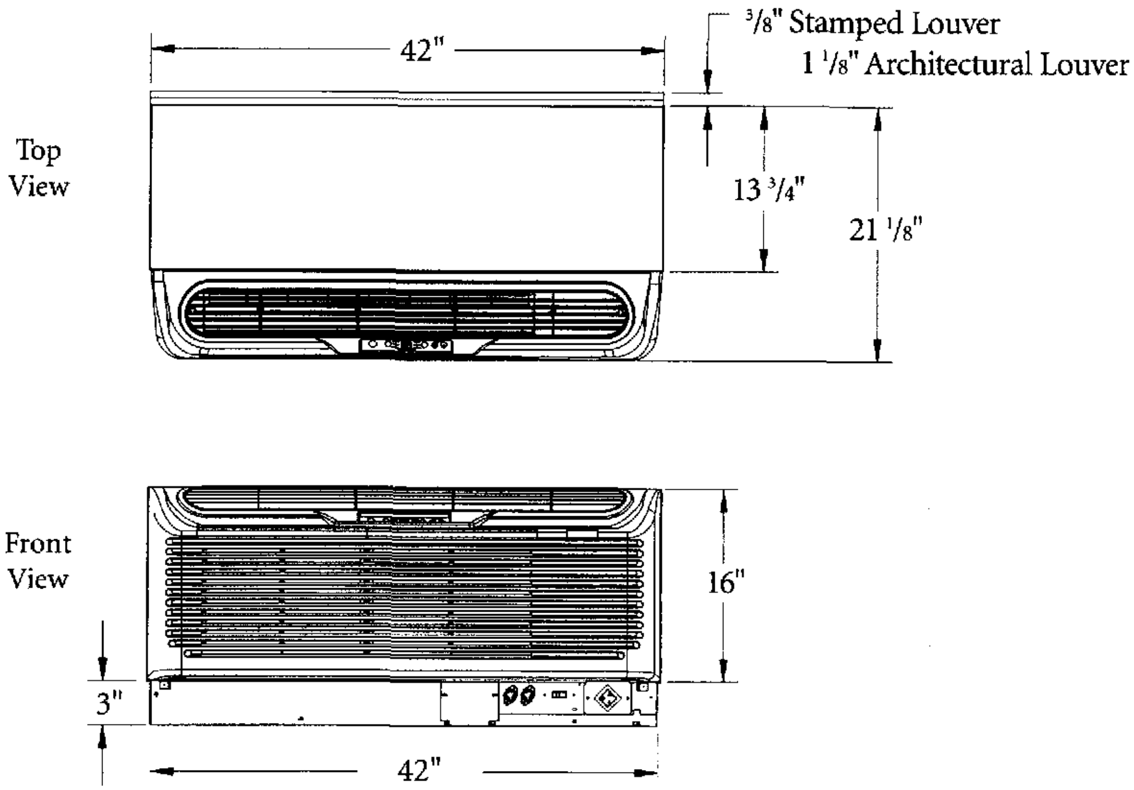

230/208 Volt 20 Amp


230/208 Volt 30 Amp

SUB-BASES				
	ASB010A	ASB011A	ASB012A	ASB013A
Voltage	N/A	208/230	208/230	208/230
Amps	N/A	15	20	30
Receptacles	N/A	NEMA6-15R	NEMA6-20R	NEMA6-30R

The correct heater kit for the installation is determined by the voltage and amperage of the electrical circuit and the means of connecting the unit to the building wiring. If the unit is to be plugged into a receptacle, an LCDI power cord kit must be used. See Heater Table above for heater kW and branch circuit ampacity.

DIMENSIONS



Note: Unit pictured with subbase installed.
Subbase is optional on 208/230V units, but required on all 265V units.

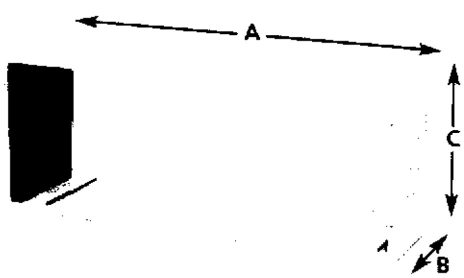
Wall Sleeve Dimensions

Heavy gauge powder-coated steel cabinet with insulation

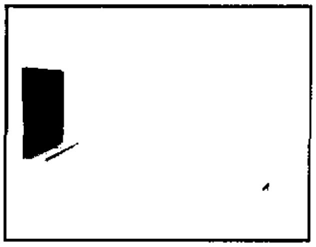
AWS010 Wall Sleeve

A = 42" **B** = 13¾" **C** = 16"

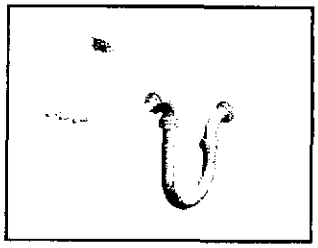
Wall Opening Dimensions
Add 1/4" to A and C Dimensions



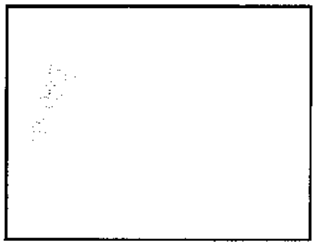
ACCESSORIES



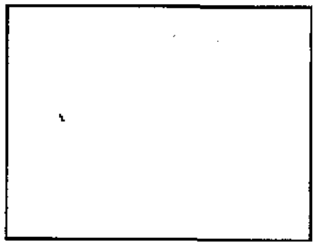
PTAC Wall Sleeve
Part #AWS010A
Insulated wall sleeve for thermal efficiency and quiet sound operation. Includes weatherboard, rear panel.



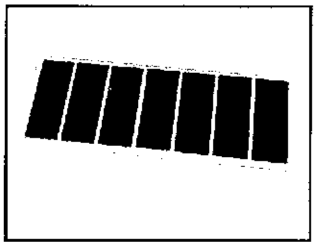
Hardwire Kit
Part # AHW011A-208/230, 15AMP
Part # AHW012A-208/230, 20AMP
Part # AHW013A-208/230, 30AMP
Provides unit with a direct electrical connection.



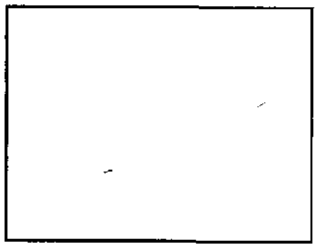
Architectural Rear Grille
Part #AAG010A
Extruded aluminum rear grille.



Replacement Filters (2 Pack)
Part #ASP010A
Original PTAC return air filters that are reusable and can be cleaned by vacuuming or washing out.

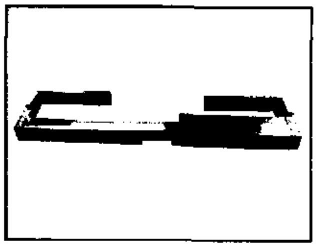


Stamped Aluminum Grille
Part #ASG010A
Rear grille, stamped aluminum resists chalking and oxidation.



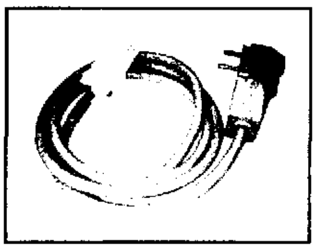
Decorative Cover Kit
Part #ACV010A
Covers control panel when using a remote thermostat.

Internal/External Drain Kit
Part #ADK010A
Mounts to the bottom of the wall sleeve for internal drains of condensate or to the rear of the wall sleeve for external drainage. Highly recommended for Heat Pump models.



Sub-bases
Conceal wiring while providing additional unit support. Provides easy access and installation by supplying a plug-in receptacle, fuse holders and disconnect switches.

Part #ASB010A - 3" Sub-base-Non Electric
Part #ASB011A - 3" Sub-base-208/220 Volts, 15 Amps
Part #ASB012A - 3" Sub-base-208/230 Volts, 20 Amps
Part #ASB013A - 3" Sub-base-208/230 Volts, 30 Amps
Part #ASB014A - 3" Sub-base-265 Volts, 15 Amps
Part #ASB015A - 3" Sub-base-265 Volts, 20 Amps
Part #ASB016A - 3" Sub-base-265 Volts, 30 Amps



LCDI Power Cord
Part # APC011A-208/230, 15AMP
Part # APC012A-208/230, 20AMP
Part # APC013A-208/230, 30AMP
(See page 3 for additional information.)

Nomenclature

A 6 PTAC 09 U W 2 A A

Product Brand
A - Fedders

Controls
6 - Electronic Controls

Chassis Series
PTAC - Cool Model
PTHP - Heat Pump Model

BTU Capacity

Heater Sizes
0 - No Heater
U - Universal Heater

Installation
W - Wall Mount

Voltage
2 - 115V / 60 Hz
7 - 230-208V / 60 Hz
9 - 265V / 60 Hz

Manufacturer Code

Revision Letter

Fedders Corporation
505 Martinsville Rd.
Liberty Corner, NJ 07938 USA
(908) 604-8686
Form No. F-PTAC-1006

FD-0100806g

Quick Specs

Dimensions
Width : 26"
Depth : 21 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 9000
Maximum Cooling Amps : 4.2
Maximum Cooling Watts : 967
Heating Capacity (BTU) : 8500
Maximum Heating Amps : 3.7
Maximum Heating Watts : 857
Heat : Heat Pump with Electric Heat Backup
CFM Room Circulation : 258
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : Yes
ADA Compliant : No
Plug Type : 6-20P

Angled Left

Amana

Amana PBH093B35MB

9,000 BTU Through-the-Wall Mini-PTAC with 8,500 BTU Heat Pump Capacity, 258 CFMs, 4-Way Adjustable Airflow and 9.4 Energy Efficiency Ratio

Your Price: $479.00
8% Off Ends Feb. 7: -$38.32
Today's Price: $440.68

Extended Warranty
Price Match Policy
E-Mail
Print

Qty: 1 Add to Cart

SHARE

Average Rating: 4.3 Read (3) Write

Additional Options

Optional Accessories

Add	**Insulated Metal Wall Sleeve** (PBWS01A) required	+ $79.00
Add	**Custom Color Architectural Grille Kit** (PBAGK01SB) preview	+ $69.00
Add	**Beige Architectural Grille Kit** (PBAGK01TB) preview	+ $69.00
Add	**Sleeve Adapter Kit** (PBFAK01A)	+ $39.00
Add	**Insulated Room-Side Panel** (PBWMFC01A)	+ $39.00

Warranties Description Specifications **Features** Reviews

Features

High Energy-Efficiency with Models up to 9.5 EER saving you money when compared to other competition models.
Easy Removable Condenser Top that allows for quick and complete cleaning of outdoor coils.
This access for cleaning the outdoor coil enables easy removal of dirt and debris to dramatically lengthen the life of the compressor and other sealed system components.
Easy Access Slide-Out Filter has a permanent polypropylene filter mesh that is easy to remove and clean.
100% Full Factory Run Test on all units for high reliability and dependability. Units start the first time - every time!
4-Way Adjustable Airflow to allow for cooling or heating to any part of the room.
Quiet Operation.
Designed with guest comfort in mind - providing reliable, quiet operation for years to come.

Lineup of Similar Amana Air Conditioners

Products 1-5 of 5

Items to Compare

Amana PSE093B35MB	Amana PBH093B35MB	Amana PBH092B12MB	Amana PBE123B35MB	Amana PBH113A35MA
1	2	3	4	5

ATCH #9

Quick Specs

Dimensions
Width : 26"
Depth : 21 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 9300
Maximum Cooling Amps : 4.2
Maximum Cooling Watts : 964
Heating Capacity (BTU) : 11000
Maximum Heating Amps : 15.2
Maximum Heating Watts : 3500
Heat : *Electric Heat*
CFM Room Circulation : 258
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P
[illegible]

Angled Left

Amana

Amana PBE093B35MB

9,300 BTU Through-the-Wall Mini-PTAC with 11,000 BTU Electric Heat Capacity, 258 CFMs, 4-Way Adjustable Airflow and 9.5 Energy Efficiency Ratio

Your Price:	$469.00
8% Off Ends Feb. 7:	-$37.52
Today's Price:	$431.48

Extended Warranty
Price Match Policy
E-Mail
Print

Qty: 1 Add to Cart

SHARE

Be the first to write a review.

Additional Options

Optional Accessories

Add	**Insulated Metal Wall Sleeve** (PBWS01A) (Required)	+ $79.00
Add	**Beige Architectural Grille Kit** (PBAGK01TB) preview	+ $69.00
Add	**Insulated Room-Side Panel** (PBWMFC01A)	+ $39.00
Add	**Custom Color Architectural Grille Kit** (PBAGK01SB) preview	+ $69.00
Add	**Sleeve Adapter Kit** (PBFAK01A)	+ $39.00

Warranties | Description | Specifications | **Features** | Reviews

Features

High Energy-Efficiency with Models up to 9.5 EER saving you money when compared to other competition models.
Easy Removable Condenser Top that allows for quick and complete cleaning of outdoor coils.
This access for cleaning the outdoor coil enables easy removal of dirt and debris to dramatically lengthen the life of the compressor and other sealed system components.
Easy Access Slide-Out Filter has a permanent polypropylene filter mesh that is easy to remove and clean.
100% Full Factory Run Test on all units for high reliability and dependability. Units start the first time - every time!
4-Way Adjustable Airflow to allow for cooling or heating to any part of the room.
Quiet Operation. Designed with guest comfort in mind providing reliable, quiet operation for years to come.

Note: Chassis are sold without a wall sleeve and can retro-fit into GE, Amana and many other 26" solid-sided sleeves.

Lineup of Similar Amana Air Conditioners

Products 1-5 of 5

Items to Compare

1	2	3	4	5
Amana PBE093B35MB	Amana PBH093B35MB	Amana PBH092B12MB	Amana PBE123B35MB	Amana PBH113A35MA

Quick Specs

Dimensions
Width : 26"
Depth : 21 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 5.4
Maximum Cooling Watts : 1231
Heating Capacity (BTU) : 11000
Maximum Heating Amps : 15.2
Maximum Heating Watts : 3500
Heat : Electric Heat
CFM Room Circulation : 270
Energy Efficiency Rating : 9.4
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P
[redacted]

Angled Left

Amana

Amana PBE123B35MB

11,600 BTU Through-the-Wall Mini-PTAC with 11,000 BTU Electric Heat Capacity, 270 CFMs, 4-Way Adjustable Airflow and 9.4 Energy Efficiency Ratio

Your Price: $499.00
8% Off Ends Feb. 7: -$39.92
Today's Price: $459.08

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Be the first to write a review.

Additional Options

Optional Accessories

Add	**Insulated Metal Wall Sleeve** (PBWS01A) (required)	+ $79.00
Add	**Custom Color Architectural Grille Kit** (PBAGK01SB) preview	+ $69.00
Add	**Beige Architectural Grille Kit** (PBAGK01TB) preview	+ $69.00
Add	**Sleeve Adapter Kit** (PBFAK01A)	+ $39.00
Add	**Insulated Room-Side Panel** (PBWMFC01A)	+ $39.00

Warranties | Description | Specifications | **Features** | Reviews

Features

High Energy-Efficiency with Models up to 9.5 EER saving you money when compared to other competition models.
Easy Removable Condenser Top that allows for quick and complete cleaning of outdoor coils.
This access for cleaning the outdoor coil enables easy removal of dirt and debris to dramatically lengthen the life of the compressor and other sealed system components.
Easy Access Slide-Out Filter has a permanent polypropylene filter mesh that is easy to remove and clean.
100% Full Factory Run Test on all units for high reliability and dependability. Units start the first time - every time!
4-Way Adjustable Airflow to allow for cooling or heating to any part of the room.
Quiet Operation. Designed with guest comfort in mind - providing reliable, quiet operation for years to come.

Note: Chassis are sold without a wall sleeve and can retro fit into GE, Amana and many other 26" solid-sided sleeves

Lineup of Similar Amana Air Conditioners

Products 1-5 of 5

Items to Compare

1	2	3	4	5
Amana PBE093B35MB	Amana PBH093B35MB	Amana PBH092B12MB	Amana PBE123B35MB	Amana PBH113A35MA

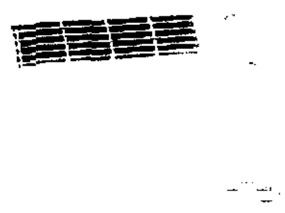
Quick Specs

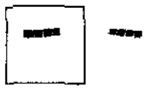
Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11000
Maximum Cooling Amps : 5.7
Maximum Cooling Watts : 1228
Heating Capacity (BTU) : 10100
Maximum Heating Amps : 4.8
Maximum Heating Watts : 1055
Heat : Heat Pump with Electric Heat Backup
CFM Room Circulation : 270
Energy Efficiency Rating : 9
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
Voltage : 230/208 Volts

Angled Left





Amana

Amana PBH113A35MA

11,000 BTU Built-in PTAC with 4-Way Adjustable Airflow and Heat Pump @ 230/208 Volts

Your Price: $519.00
8% Off Ends Feb. 7: -$41.52
Today's Price: $477.48

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Average Rating: 4 Read (1) Write

Additional Options

Add	**Solid-Side Wall Sleeve (PBWS01A)** (PBWS01A) (required)	+ $79.00
Add	**Digital Thermostat with 2 Stage Heating and 2 Stage Cool** (1246002) preview	+ $59.00
Add	**Condenser Baffle Kit** (DGK1B) preview	+ $19.00
Add	**Internal Drain Kit (DK900D)** (DK900D) preview	+ $19.00

Warranties | Description | Specifications | Features | Reviews

Extended Warranties

Add	**2 Year Warranty** for a Major Appliance Under $1,500	$36.99
Add	**3 Year Warranty** for a Major Appliance Under $1,500	$67.99
Add	**5 Year Warranty** for a Major Appliance Under $1,500	$124.99

Description

The PBH113A35MA has a 4-way adjustable airflow to allow for cooling or heating to any part of the room and a high energy-efficiency that saves you money when compared to other competition models. It also features an easy removable condensor top that allows for quick and complete cleaning of outdoor coils. This access for cleaning the outdoor coil enables easy removal of dirt and debris to dramatically lengthen the life of the compressor and other sealed system components. Six easy access screws and let the cleaning begin! Not available on competitor models.

Specifications

Dimensions

PBWS01A Wall Sleeve Height: 15 5/8"

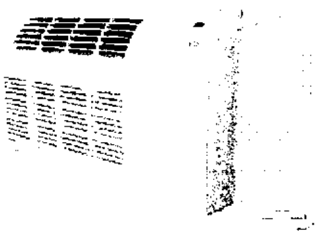
Quick Specs

Dimensions
Width : 25 49/50"
Depth : 16 22/25"
Height : 15 31/50"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 5.4
Maximum Cooling Watts : 1230
Heating Capacity (BTU) : 11000
Maximum Heating Amps : 14.8
Maximum Heating Watts : 3400
Heat : Electric Heat
CFM Room Circulation : 280
Energy Efficiency Rating : 9.4
Control Type : Digital
Remote Control Included : Yes

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-15P
[illegible]

Featured View



SOLEUSAIR

Soleus KTW12H

11,600 BTU Thru-the-Wall Cool Electric Heat Air Conditioner with 3 Fan Speeds, Digital Temperature Display and Energy Saver Mode

Your Price: $529.00
8% Off Ends Feb. 7: -$42.32
Today's Price: $486.68

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Average Rating: 5 Read (1) Write

Additional Options

Add **Through-the-Wall AC Sleeve** (KTWS) (required) preview + $69.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

Features

- 4 Way Air Discharge
- 3 Fan Speeds
- Digital Temperature Display
- Auto Restart
- Energy Saver Mode
- Easy-Access Air Filter
- 24 Hours Timer
- Remote Control
- MFG SKU: KTW-12H

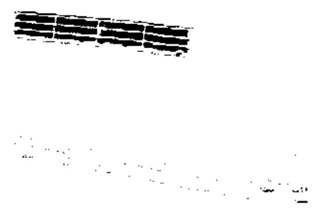
Quick Specs

Dimensions
Width : 24 5/8"
Depth : 19 5/8"
Height : 14 3/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 10000
Maximum Cooling Amps : 5.2
Maximum Cooling Watts : 1136
Heating Capacity (BTU) : 11200
Maximum Heating Amps : 15.3
Maximum Heating Watts : 3500
Heat : *Electric Heat*
CFM Room Circulation : 285
Energy Efficiency Rating : 8.8
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P

Main



Be the first to write a review.

Friedrich Uni-Fit Series UE10A33B

10,000 BTU Through-the-Wall Air Conditioner with Electric Heat, 2 Cooling/2 Heating Speeds, Mechanical Controls and 285 CFM Room Air Circulation

Your Price: $599.00
8% Off Ends Feb. 7: -$47.92
Today's Price: $551.08

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Additional Options

Add
Wall Sleeve (USC) (USC) (required) + $109.00

Warranties | Description | Energy Info | Specifications | **Features** | Info & Guides | Reviews

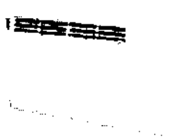
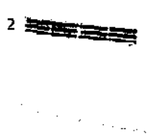
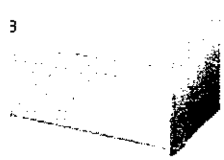
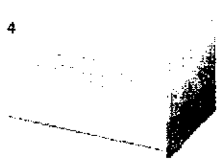
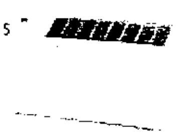
Features

Universal Fit for Easy Replacement
- High efficiency operation saves on energy costs
- Rotary compressors provide quiet, dependable performance
- Money Saver setting saves energy by cycling the fan with the compressor
- 6-way air flow control
- Stale air exhaust
- Permanent filter
- Seacoast protection
- Auto re-start
- Electronic controls with remote
- 2 cooling and 2 heating speeds, plus 1 fan-only setting

Lineup of Similar Friedrich Air Conditioners

Products 1-6 of 6 | Show All Products

Items to Compare

1	2	3	4	5
Friedrich Uni-Fit Series UE08A13B	**Friedrich Uni-Fit Series** UE10A33B	**Friedrich WallMaster Series** WE13B33B	**Friedrich WallMaster Series** WE10B33C	**Friedrich WallMaster Series** WE15C33
				
$569.00	$599.00	$729.00	$869.00	$1,039.00
Add to Compare		Add to Compare	Add to Compare	Add to Compare

Quick Specs

Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 5.8
Maximum Cooling Watts : 1220
Heating Capacity (BTU) : 11600
Maximum Heating Amps : 16
Maximum Heating Watts : 3680
Heat : Electric Heat
CFM Room Circulation : 298
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P
[illegible]

Featured View

GE J Series AJES12DCC

11,600 BTU Through-the-Wall Heat/Cool Air Conditioner with Mechanical Controls, 2 Cool/2 Heat/2 Fan Only Speeds & 298 CFM Room Circulation

Your Price: $739.00
8% Off Ends Feb. 7: -$59.12
Today's Price: $679.88

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Be the first to write a review.

Additional Options

Grilles

Add **Architectural Grille (RAG14E)** (RAG14E) preview + $69.00

Wall Cases (Choose Either One)

Add **Standard Wall Case (RAB46)** (RAB46) (required) preview + $59.00

Add **Wall Case for Tenant Option Installation (RAB48)** (RAB48) (required) preview + $79.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

Features

11,600/11,400 BTU

11,600/9,480 BTU heat

3,680/3,020 Watts heat

9.5/9.5 EER

230/208 Volts

Mechanical controls

Variable position thermostat

Four-way air direction

Up-front, washable air filter

2 cool/2 heat/2 fan only speeds

Lineup of Similar GE Air Conditioners

Products 2-6 of 10 Show All Products

Items to Compare

GE J Series AJES06LSC	GE J Series AJES10DCC	GE J Series AJES12DCC	GE J Series AJES08ASC	GE J Series AJEH12DCC

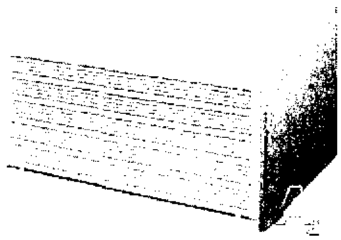
Quick Specs

Dimensions
Width : 26 1/2"
Depth : 21"
Height : 15 3/4"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 12500
Maximum Cooling Amps : 6.7
Maximum Cooling Watts : 1404
Heating Capacity (BTU) : 11000
Maximum Heating Amps : 16
Maximum Heating Watts : 3550
Heat : Electric Heat
CFM Room Circulation : 280
Energy Efficiency Rating : 8.9
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
Plug Type : 6-20P
[redacted]

Main



Friedrich WallMaster Series WE13B33B

12,500 BTU Through-the-Wall Air Conditioner with Electric Heat, 2 Cooling/2 Heating Speeds, Mechanical Controls and 280 CFM Room Air Circulation

Your Price: $729.00
8% Off Ends Feb. 7: -$58.32
Today's Price: $670.68

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Average Rating: 4 Read (1) Write

Additional Options

Add	**Wall Sleeve for Wallmasters Units** (WSD) (required)	+ $109.00
Add	**Baffle Adapter Kit** (BAK) preview	+ $29.00
Add	**Drain Kit** (DK) preview	+ $29.00
Add	**Sub Base** (SB Friedrich)	+ $59.00

Warranties | Description | Energy Info | Specifications | **Features** | Info & Guides | Reviews

Features

The Most Energy Efficient Solid-side Air Conditioner
- High efficiency operation saves on energy costs
- Residential/ commercial application
- Mounts flush with the exterior wall for a neat appearance
- Ideal for thicker wall installations, where side fins don't fit
- Exact fit for Fedders A and B sleeves. Sleeves measures 27" W x 16 3/4' H
- Easy-to-reach, top mount controls
- Three-speed fan
- Magna 1 copper coils
- Efficient rotary compressor
- Easy-to-clean filter

WallMaster Exterior Grilles
- Operating the air conditioner with incorrect rear grille or without Baffle Adapter Kit (on 19 3/4" deep sleeve) will recirculate discharge air and cause compressor overload to trip.

DK/ Drain Kit
- Installed at the back of the unit
- Allows for attachment to permanent condensate disposal system, if disposal is necessary or desired

SB / Sub Base
- Used as a base for the unit when it is desired to place the cord and receptacle within the installation, or simply as a base for the unit when mounted low in the wall.

IDK/ Internal Drain Kit
- New construction applications with reverse cycle units where a condensate drain system has been built into the wall interior.

BAK/ Baffle Adapter Kit
- Necessary when installing in a sleeve deeper than 16 3/4" deep, such as Fedders B sleeve (19 3/4" deep)

Lineup of Similar Friedrich Air Conditioners

Products 1-6 of 6 Show All Products

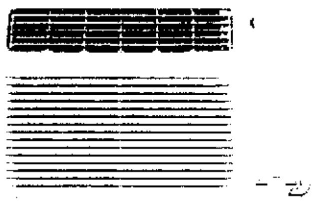
Quick Specs

Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 8550
Maximum Cooling Amps : 4.3
Maximum Cooling Watts : 840
Heating Capacity (BTU) : 11600
Maximum Heating Amps : 16
Maximum Heating Watts : 3660
Heat : Heat Pump with Electric Heat Backup
CFM Room Circulation : 237
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : Yes
ADA Compliant : No
Plug Type : 6-20R
Voltage : 230/208 Volts

Featured View



Be the first to write a review.

GE J Series AJHS08DCC

8,550 BTU Through-the-Wall Heat Pump Air Conditioner with Mechanical Controls 2 Cool/2 Heat/2 Fan Only Speeds and 237 CFM Room Circulation

Your Price:	$889.00
8% Off Ends Feb. 7:	-$71.12
Today's Price:	$817.88

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Additional Options

Grilles

Add	**Architectural Grille** (RAG14E) preview	+ $69.00

Wall Cases (Choose Either One)

Add	**Standard Wall Case** (RAB46) (required) preview	+ $59.00
Add	**Wall Case for Tenant Option Installation** (RAB48) (required) preview	+ $79.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

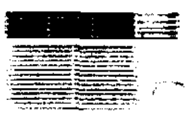
Features

8,550/8,300 BTU
7,700/7,500 BTU pump
11,600/9,500 BTU strip
9.5/9.5 EER
230/208 Volts
Mechanical controls
Variable position thermostat
Four-way air direction
Up-front, washable air filter
2 cool/2 heat/2 fan only speeds

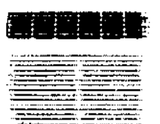
Lineup of Similar GE Air Conditioners

Products 6-10 of 10 Show All Products

Items to Compare

GE J Series
AJEH12DCC
6 
$759.00
Add to Compare

GE J Series
AJES10DSC
7 
$789.00
Add to Compare

GE J Series
AJHS08DCC
8 
$889.00

GE J Series
AJHS08ASC
9 
$929.00
Add to Compare

GE J Series
AJHS10DCC
10 
$939.00
Add to Compare

Home > Air Conditioners > Through the Wall > WS16B30A

0 Items in My Cart

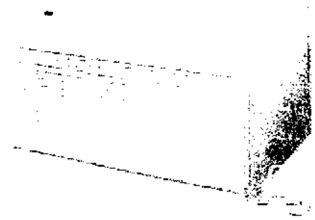
Quick Specs

Dimensions
Width : 26 1/2"
Depth : 21"
Height : 15 3/4"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 15800
Maximum Cooling Amps : 8.5
Maximum Cooling Watts : 1756
Heat : No
CFM Room Circulation : 290
Energy Efficiency Rating : 9
Control Type : Digital
Remote Control Included : Yes

Technical Details
Energy Star Rated : No
Plug Type : 6-15P
Voltage : 230/208 Volts

Main



Be the first to write a review.

Friedrich WallMaster Series WS16B30A

15,800 BTU Through-the-Wall Air Conditioner with 24-Hour Programmable Timer, Remote Control and 290 CFM Room Air Circulation

Your Price:	$979.00
8% Off Ends Feb. 7:	-$78.32
Today's Price:	$900.68

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Additional Options

Add	**Wall Sleeve for Wallmasters Units** (WSD) (required)	+ $109.00
Add	**Drain Kit** (DK) preview	+ $29.00
Add	**Sub Base** (SB Friedrich)	+ $59.00
Add	**Baffle Adapter Kit** (BAK) preview	+ $29.00

Warranties | Description | Energy Info | Specifications | **Features** | Info & Guides | Reviews

Features

The Most Energy Efficient Solid-side Air Conditioner
- High efficiency operation saves on energy costs
- Residential/ commercial application
- Mounts flush with the exterior wall for a neat appearance
- Ideal for thicker wall installations, where side fins don't fit
- Exact fit for Fedders A and B sleeves. Sleeves measures 27" W x 16 3/4" H
- Easy-to-reach, top mount controls
- Three-speed fan
- Magna 1 copper coils
- Efficient rotary compressor
- Easy-to-clean filter

Remote Control Features (cool only models)
- 24 hour programmable timer
- Money Saver setting saves energy by cycling the fan with the compressor
- Smart Fan auto-adjusts fan speed to maintain desired temperature
- Auto-memory backup

WallMaster Exterior Grilles
- Operating the air conditioner with incorrect rear grille or without Baffle Adapter Kit (on 19 3/4" deep sleeve) will recirculate discharge air and cause compressor overload to trip.

DK / Drain Kit
- Installed at the back of the unit
- Allows for attachment to permanent condensate disposal system, if disposal is necessary or desired

SB / Sub Base
- Used as a base for the unit when it is desired to place the cord and receptacle within the installation, or simply as a base for the unit when mounted low in the wall.

IDK / Internal Drain Kit
- New construction applications with reverse cycle units where a condensate drain system has been built into the wall interior

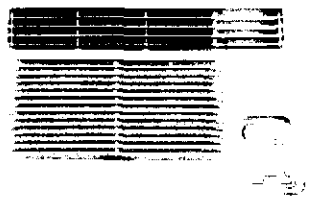
Quick Specs

Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 6.3
Maximum Cooling Watts : 1220
Heating Capacity (BTU) : 11600
Maximum Heating Amps : 16
Maximum Heating Watts : 3680
Heat : Electric Heat
CFM Room Circulation : 298
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P

Feature View



Be the first to write a review.

GE J Series AJEH12DCC

11,600 BTU Through-the-Wall Heat/Cool Air Conditioner with Mechanical Controls, 2 Cool/2 Heat/2 Fan Only Speeds & 298 CFM Room Circulation

Your Price:	$759.00
8% Off Ends Feb. 7!	-$60.72
Today's Price:	$698.28

Qty: 1

Additional Options

Grilles

Add	**Architectural Grille** (RAG14E) preview	+ $69.00

Wall Cases (Choose Either One)

Add	**Standard Wall Case** (RAB46) preview	+ $59.00
Add	**Wall Case for Tenant Option Installation** (RAB48) preview	+ $79.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

Features

11,600/11,400 BTU

11,600/9,500 BTU heat

3,680/3,020 Watts heat

9.5/9.5 EER

230/208 Volts

Mechanical controls

Variable position thermostat

Four way air direction

Up-front, washable air filter

2 cool/2 heat/2 fan only speeds

Lineup of Similar GE Air Conditioners

Products 4-8 of 10 Show All Products

Items to Compare

GE J Series	GE J Series	GE J Series	GE J Series	GE J Series
AJES12DCC	AJES08ASC	AJEH12DCC	AJES10DSC	AJHS08DCC

Quick Specs

Dimensions
Width : 24"
Depth : 20 1/8"
Height : 14 3/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 13000
Maximum Cooling Amps : 7.0
Maximum Cooling Watts : 1530
Heat : No
CFM Room Circulation : 300
Energy Efficiency Rating : 8.5
Control Type : Digital
Remote Control Included : Yes

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-15P
Voltage : 230/208 Volts

Main

Friedrich Uni-Fit Series US14B30A

13,000 BTU Through-the-Wall Air Conditioner with 3 Cooling/3 Fan-Only Speeds, Electronic Controls, Remote Control and 300 CFM Room Air Circulation

Your Price: $669.00
8% Off
Ends Feb. 7: -$53.52
Today's Price: $615.48

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
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Additional Options

Add **Wall Sleeve (USC)** (USC) (required) + $109.00

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Warranties | Description | Energy Info | Specifications | **Features** | Reviews

Features

Universal Fit for Easy Replacement
- High efficiency operation saves on energy costs
- Rotary compressors provide quiet, dependable performance
- Money Saver setting saves energy by cycling the fan with the compressor
- 6-way air flow control
- Stale air exhaust
- Permanent filter
- Seacoast protection
- Auto re-start
- Electronic controls with remote
- 3 cooling/3 fan-only speeds

Lineup of Similar Friedrich Air Conditioners

Products 4-8 of 12 Show All Products

Items to Compare

Friedrich Uni-Fit Series US10B30A	Friedrich Uni-Fit Series US12B10B	Friedrich Uni-Fit Series US14B30A	Friedrich WallMaster Series WS08B10A	Friedrich WallMaster Series WS10B10A
4	5	6	7	8
$539.00	$599.00	$669.00	$689.00	$749.00
Add to Compare	Add to Compare		Add to Compare	Add to Compare

Quick Specs

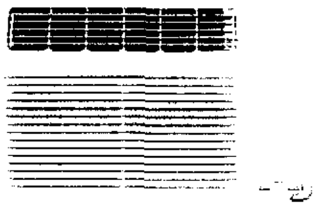
Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 6.3
Maximum Cooling Watts : 1220
Heat : No
CFM Room Circulation : 298
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : Yes
ADA Compliant : No
Plug Type : 6-15P

[redacted]

Featured View



[redacted]

11,600 BTU Through-the-Wall Cool Only Air Conditioner with Mechanical Controls, 2 Cool/2 Fan Speeds & 298 CFM Room Circulation

Your Price: $519.00
8% Off Ends Feb. 7: -$41.52
Today's Price: $477.48

Qty: 1 [redacted]

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Be the first to write a review.

Additional Options
Grilles

Add **Architectural Grille (RAG14E)** (RAG14E) preview + $69.00

Wall Cases (Choose Either One)

Add **Standard Wall Case (RAB46)** (RAB46) (required) preview + $59.00

Add **Wall Case for Tenant Option Installation (RAB48)** (RAB48) (required) preview + $79.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

Features

11,600/11,400 BTU

9.5/9.5 EER

230/208 Volts

ENERGY STAR qualified

Mechanical controls

Variable position thermostat

Four-way air direction

Easy-front, washable air filter

2 Cool/2 fan speeds

Lineup of Similar GE Air Conditioners

Products 11-15 of 16 Show All Products

Items to Compare

11	12	13	14	15
GE J Series AJCH10ACC	GE J Series AJCQ10DCC	GE J Series AJCS12DCC	GE J Series AJCQ12DCC	GE J Series AJCQ12ACC

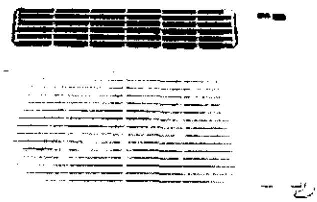
Quick Specs

Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 11600
Maximum Cooling Amps : 6.3
Maximum Cooling Watts : 1220
Heat : No
CFM Room Circulation : 304
Energy Efficiency Rating : 9.5
Control Type : Digital
Remote Control Included : Yes

Technical Details
Energy Star Rated : Yes
ADA Compliant : Yes
Plug Type : 6-15P

Featured View



Be the first to write a review.

11,600 BTU Through-the-Wall Cool Only Air Conditioner with Electronic Controls, 3 Cool/3 Fan Speeds, 304 CFM Room Circulation and ADA Compliant

Your Price: $529.00
8% Off Ends Feb. 7: -$42.32
Today's Price: $486.68

Qty: 1

Extended Warranty
Price Match Policy
E-Mail
Print
SHARE

Additional Options

Grilles

Add	**Architectural Grille (RAG14E)** (RAG14E) preview	+ $69.00

Wall Cases (Choose Either One)

Add	**Standard Wall Case (RAB46)** (RAB46) (required) preview	+ $59.00
Add	**Wall Case for Tenant Option Installation (RAB48)** (RAB48) (required) preview	+ $79.00

Warranties | Description | Specifications | **Features** | Info & Guides | Reviews

Features

11,600/11,400 BTU

9.5/9.5 EER

230/208 Volts

Energy Star qualified

Electronic digital thermostat with remote

Four-way air direction

3 cool/3 fan speeds

Slide-front, washable air filter

Power interruption restart

Lineup of Similar GE Air Conditioners

Products 12-16 of 16 Show All Products

Items to Compare

12	13	14	15	16
GE J Series AJCQ10DCC	GE J Series AJCS12DCC	GE J Series AJCQ12DCC	GE J Series AJCQ12ACC	GE J Series AJCH12DCC

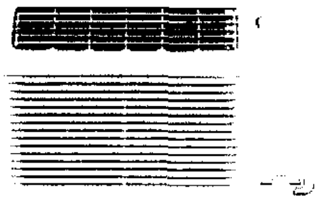
Quick Specs

Dimensions
Width : 26"
Depth : 16 7/8"
Height : 15 5/8"

Features
Chassis Type : Slide out
Type : Thru-the-Wall
Wall Sleeve Included : Yes
Cooling Capacity (BTU) : 10150
Maximum Cooling Amps : 5.3
Maximum Cooling Watts : 1040
Heating Capacity (BTU) : 11600
Maximum Heating Amps : 16
Maximum Heating Watts : 3670
Heat : Electric Heat
CFM Room Circulation : 292
Energy Efficiency Rating : 9.5
Control Type : Rotary
Remote Control Included : No

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20P

Featured View



10,150 BTU Through-the-Wall Heat/Cool Air Conditioner with Mechanical Controls, 2 Cool/2 Heat/2 Fan Only Speeds & 292 CFM Room Circulation

Your Price: $789.00
8% Off Ends Feb. 7: -$63.12
Today's Price: $725.88

Price Match Policy
E-Mail
Print
SHARE

Qty: 1

Be the first to write a review.

Additional Options
Grilles
Add
Architectural Grille (RAG14E) preview + $69.00

Description | Specifications | **Features** | Info & Guides | Reviews

Features

9,300/9,700 BTU

11,600/9,460 BTU heat

3,670/3,010 Watts heat

9.5/9.5 EER

230/208 Volts

Mechanical controls

Variable position thermostat

Four-way air direction

Up-front, washable air filter

2 cool/2 heat/2 fan only speeds

Lineup of Similar GE Air Conditioners

Products 5-9 of 10 Show All Products

Items to Compare

GE J Series AJES08ASC
5 
$749.00

GE J Series AJEH12DCC
6 
$759.00

GE J Series AJES10DSC
7 
$789.00

GE J Series AJHS08DCC
8 
$889.00

GE J Series AJHS08ASC
9 
$929.00

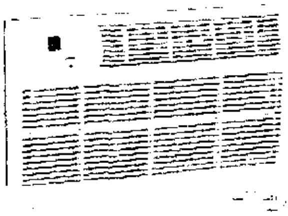
Quick Specs

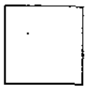
Dimensions
Width : 24"
Depth : 20 1/2"
Height : 14 1/2"

Features
Chassis Type : Slide out
Type : Window/Wall
Wall Sleeve Included : No
Cooling Capacity (BTU) : 12000
Maximum Cooling Amps : 6.5
Maximum Cooling Watts : 1335
Heating Capacity (BTU) : 10600
Maximum Heating Amps : 16
Maximum Heating Watts : 3450
Heat : Electric Heat
CFM Room Circulation : 264
Energy Efficiency Rating : 9
Control Type : Digital
Remote Control Included : Yes

Technical Details
Energy Star Rated : No
ADA Compliant : No
Plug Type : 6-20 [redacted]

Featured View





Gibson

[redacted]

12,000 BTU Room Air Conditioner with Electric Heat, 640 sq. ft. Cooling Area, 264 CFM, 3 Fan Speeds, 4-Way Air Direction, Slide-Out Filter Access, Remote Control and Electronic Controls

Your Price: $439.00
8% Off Ends Feb. 7: -$35.12
Today's Price: $403.88

Price Match Policy
E-Mail
Print
SHARE

Qty: 1

Average Rating: 5 Read (1) Write

Additional Options

Add	**Window Mounting Kit** (EA102T) preview	+ $59.00
Add	**Through-The-Wall Builder Sleeve** (EA108T) preview	+ $79.00
Add	**Attractive Architectural Grille** (EA109T) preview	+ $59.00

Description | Energy Info | Specifications | **Features** | Info & Guides | Reviews

Features

12,000 BTUH Cooling Capacity
10,600 BTUH Heating Capacity
230/208 Voltage
3 Fan Speeds
Units Have Full-Function Electronic Controls with Remote
Cools Up to 640 Sq. Ft. Rooms
4-Way Air Direction Control
Fits All Existing Wall Sleeves
Optional Window Mounting Kit Available
Included Standard Universal Interior Trim Kit Allows Unit to Neatly Fit Into Any Existing Sleeve
Universal Trim Kit Covers Space Between the Sleeve and Unit
Available at AJ Madison

Lineup of Similar Gibson Air Conditioners

Products 1-4 of 4

Items to Compare

1 Gibson GAH085Q1T

$349.00
Add to Compare

2 Gibson GAH105Q2T

$369.00
Add to Compare

3 Gibson GAH126R2T

$399.00
Add to Compare

4 Gibson GAH12ER2T

$439.00

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Buying Room AC
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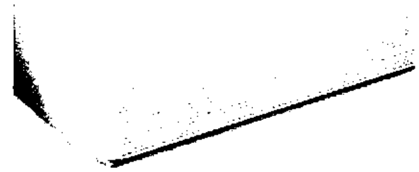
Amana
American Standard
AquaCal
Arcoaire
Axeman-Anderson
Ariston
Armstrong
Biasi
Bryant
Buderus
Burnham
Carrier
Central Boiler
Centurion
Clare

Package Terminal Air Conditioners (PTAC)

Did your local HVAC contractor suggest a PTAC Air Conditioner (Package Terminal Air Conditioner), but neglect to explain what one is? Often used in the hospitality industry, a PTAC is a self-contained air conditioner installed through-the-wall of rooms with an outside wall. One PTAC is installed for each room, and the occupant of each room can control the temperature of that room independently from other rooms. Some PTAC units include an optional heating unit as well.



How Cost-effective are They?

Because PTAC units are typically installed in rooms with a wall leading directly to the outside, they don't require ductwork, which can substantially reduce both installation cost and the amount of space needed for installation. However, they are typically less efficient than central air conditioning systems, which increases their cost over time.

What is the best climate for PTAC Air Conditioners?

Moderate climates are best suited for PTAC Air Conditioners. Severe cold or hot weather will overwork the unit, compromising its efficiency.

Advantages

- **Inexpensive to purchase per unit** Because PTAC Air Conditioners are purchased on a per-room-needed basis, you need only buy the units one at a time.
- **Inexpensive to operate** Because PTAC Air Conditioners are self-contained units that heat each room individually, you only use the amount of energy that it takes to heat or cool a room unlike other heating systems, such as central heat and air that heat or cool an entire house.
- **Energy Efficient** You won't waste energy by heating/cooling rooms that are not being used.

Disadvantages

Purchasing can be costly if buying several units at a time to heat/cool the entire house. PTACs are often noisier than comparably powerful mini-split air conditioners.

Which companies make PTAC Air Conditioners?

Several companies manufacture PTAC Air Conditioners including:

ATCH #10

Coleman
Columbia
Comfortmaker
Daikin
Dayton
DeLonghi
DMO Industries
Dornback
Ducane
Dunkirk
Emerson
Evcon
Fedders
Friedrich
Frigidaire
Fulton
General Electric
Gibson
Glowcore
Goldstar
Goodman
Haier
Hallmark
Hamilton Engineering
Heil
Homart
Intertherm
Janitrol
Keeprite
Kenmore
Kerr
Laars
Lennox
Luxaire
Maytag
Mitsubishi
Munchkin
Newmac
Olsen / Airco
Oneida Royal
Parker
Payne
Peerless
Pennco

- Amana
- Amcor
- Carrier
- Fedders
- Friedrich
- Frigidaire
- GE
- Islandaire
- LG
- Sanyo

AIR CONDITIONER
REPAIR AND REPLACEMENT EXPENSE

- 2/09/2003 Repair Air Conditioners $160.00
- 2/12/2003 Repair Air Conditioners 580.00
- 3/02/2003 Repair Air Conditioners 420.00
- 3/20/2003 Repair Air Conditioners 144.38
- 6/26/2003 Repair Air Conditioners 40.00
- 7/02/2003 Repair Air Conditioners 145.45
- 7/23/2003 Repair Air Conditioners 100.00
- 4/13/2004 Repair Air Conditioners 49.95
- 4/27/2004 Repair Air Conditioners 108.00
- 6/19/2004 Repair Air Conditioners 264.95
- 7/16/2004 Replace AC Compressor 106.50
- 7/28/2004 Repair Air Conditioners 146.50
- 8/24/2004 Repair Air Conditioners 106.50
- 9/08/2004 Repair Air Conditioners 94.50
- 9/17/2004 Repair Air Conditioners 107.45
- 10/22/2004 Repair Air Conditioners 264.95
- 5/15/2005 Repair Air Conditioners 63.98
- 7/06/2005 Repair Air Conditioners 97.00
- 7/24/2005 Repair Air Conditioners 240.59
- 8/18/2005 Repair Air Conditioners 258.50
- 9/02/2005 Repair Air Conditioners 170.50
- 11/11/2005 Repair Air Conditioners 196.45
- 3/18/2006 Repair Air Conditioners 80.00
- 6/11/2006 Repair Air Conditioners 292.00
- 7/31/2006 Repair Air Conditioners 427.60
- 8/18/2006 Replace AC Compressor 100.95
- 9/02/2005 Replace AC Compressor 170.50
- 10/12/2006 Repair Air Conditioners 121.95
- 11/15/2006 Repair Air Conditioners 120.00
- 2/08/2007 Repair Air Conditioners 85.25
- 5/22/2007 Repair Air Conditioners 40.00
- 6/12/2007 Repair Air Conditioners 160.00
- 6/30/2007 Repair Air Conditioners 133.00
- 7/18/2007 Repair Air Conditioners 99.92
- 8/09/2007 Repair Air Conditioners 258.70
- 8/30/2007 Repair Air Conditioners 150.50
- 9/06/2007 Repair Air Conditioners 150.50
- 11/06/2007 Repair Air Conditioners 311.00
- 3/03/2008 Repair Air Conditioners 96.95

ATCH #11

- 4/17/2008 Repair Air Conditioners 80.00
- 6/15/2008 Repair Air Conditioners 395.50
- 8/07/2008 Repair Air Conditioners 150.00
- 8/31/2008 Replacement AC Units 1,861.00
- 12/05/2008 Repair Air Conditioners 40.00
- 3/06/2009 Repair Air Conditioners 40.00
- 3/25/2009 Repair Air Conditioners 80.00
- 7/01/2009 Repair Air Conditioners 164.00
- 9/02/2009 Repair Air Conditioners 160.00
- 9/14/2009 Repair Air Conditioners 227.50
- 9/23/2008 Replacement AC Units 1,861.00
- 10/06/2009 Repair Air Conditioners 45.55
- 10/21/2009 Repair Air Conditioners 40.00
- 10/21/2009 Repair Air Conditioners 167.20
- 11/13/2009 Repair Air Conditioners 60.00
- 12/15/2009 Repair Air Conditioners

APS

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http://www.apsc.com

FAX #1

FAX COVER SHEET

DATE: 6/30/06

TO: John LaPorta

COMPANY: ACC

FAX: 542-2129

FROM: Angela Allison

COMPANY: APS

PHONE #: 250-3766

OF PAGES: 5

REMARKS:

ATCH #12

APS
THE POWER TO MAKE IT HAPPEN

Letter of Transmittal

A.P.S. Design Center

2225 W. Peoria Ave Phoenix, AZ 85021
(602) 371-6432 Fax (602) 371-6155

Date: 6/30/06	Job No.:
Attention:	
RE: America's Inn	
RUM DATA @ SES	

TO: Lynn Wheeler

WE ARE SENDING YOU

☐ Attached. ☐ Under separate cover via ________ the following items:

☐ Shop Drawings ☐ Specifications ☐ Prints ☐ Report ☐ Contract

☐ Copy of Letter ☐ Change Order ☐ Submittals ☐ Diskettes ☐ Other

COPIES	DATE	No.	DESCRIPTION
			Mr. Wheeler - someone needs
			to review these charts with you.
			RAM Pascarelli 602-809-2029

THESE ARE TRANSMITTED as checked below:

☐ For Approval ☐ Approved as submitted ☐ Resubmit ___ copies for approval

☐ For your use ☐ Approved as noted ☐ Submit ___ copies for distribution

☐ As requested ☐ Returned for correction ☐ Return ___ corrected prints

☐ For review & comment ☐ ________________

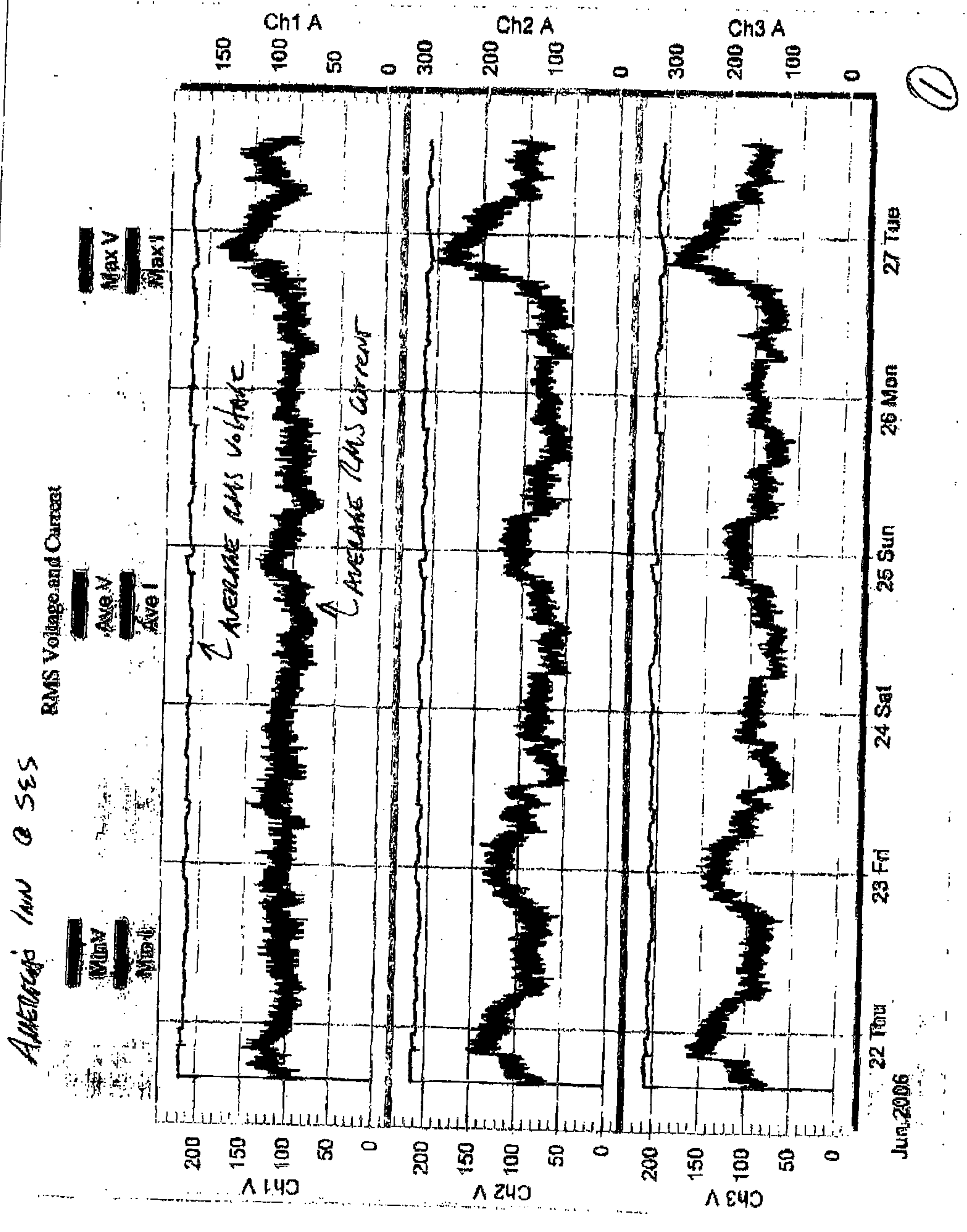
REMARKS:

COPY TO: ________________ SIGNED: ________________

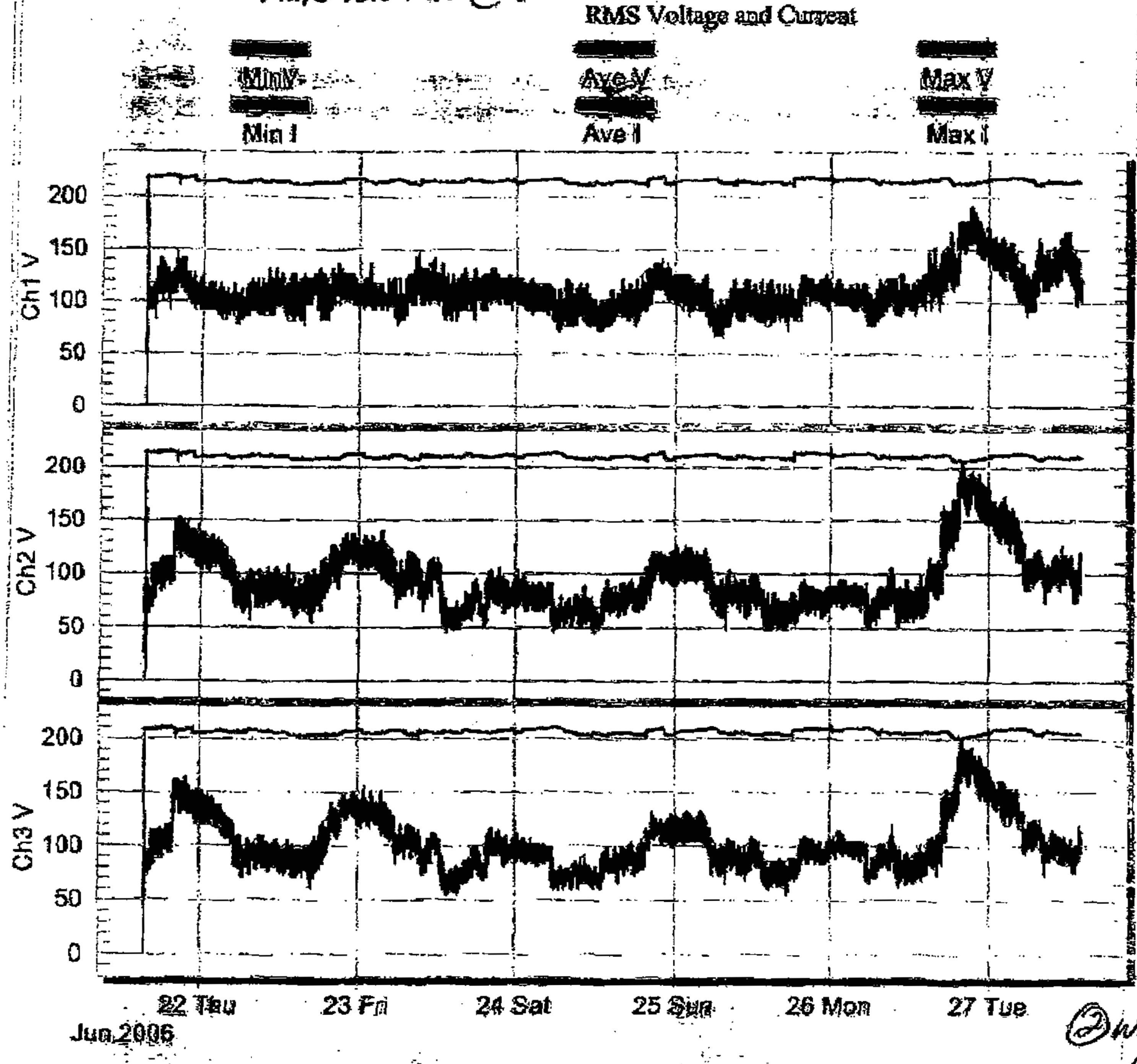
IF ENCLOSURES ARE NOT AS NOTED, KINDLY NOTIFY US AT ONCE

07/01/2006 01:04 NO.314 P03

06/30/2006 06:54 NO.649 P02



AMERICA'S INN @ SES



06/22/06 16:00:00

Ch1 V
Ch 1 ave: 210 V

Ch1 A
Ch 1 ave: 84 A

Ch2 V
Ch 2 ave: 205 V

Ch2 A
Ch 2 ave: 104 A

Ch3 V
Ch 3 ave: 202 V

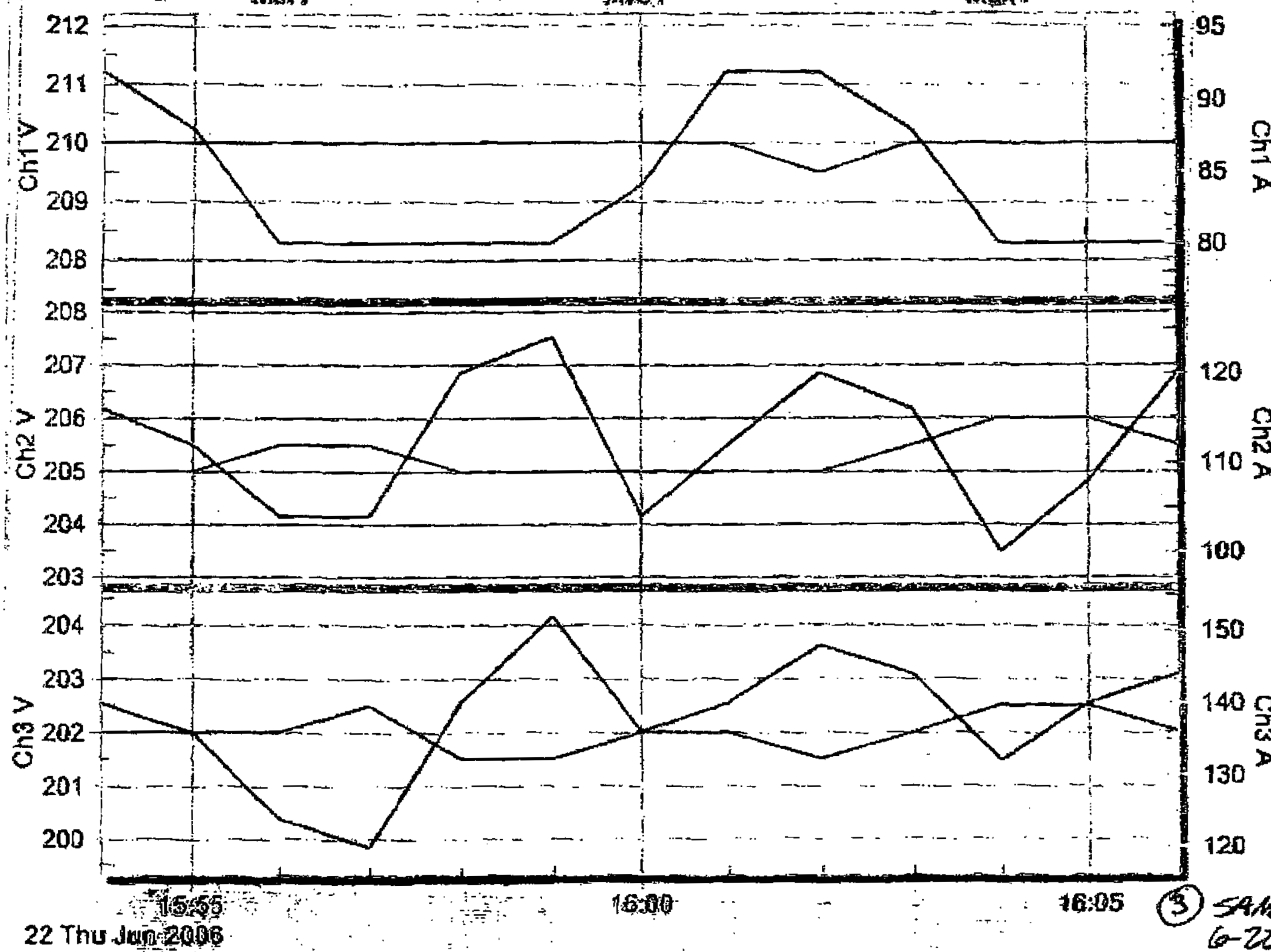
Ch3 A
Ch 3 ave: 136 A

-CHANGE
to BALANCE
LOAD AMPS
BETWEEN PHASES

2 with data LIVE AT
6-22-06 4:00pm

AMERICA'S INN @ SES

RMS Voltage and Current



06/22/06	16:00:00
Ch1 V	
Ch 1 ave:	210 V
Ch1 A	
Ch 1 ave:	84 A
Ch2 V	
Ch 2 ave:	205 V
Ch2 A	
Ch 2 ave:	104 A
Ch3 V	
Ch 3 ave:	202 V
Ch3 A	
Ch 3 ave:	136 A

3 SAME DATE +TIME
6-22, 4:00pm
ZOOMED IN

APS

A subsidiary of Pinnacle West Capital Corporation

P.O. Box 53999
Phoenix, AZ 85072-3999
http://www.aps.com

FAX #2

FAX COVER SHEET

DATE: July 10, 2006

TO: John LaPorta

FAX: 602-542-2129

RE: Lynn Wheeler

FROM: Angela Allison

COMPANY: APS

PHONE#: 602-250-2280

 # OF PAGES: 3

REMARKS: Here are the results from the original Recording Voltage Meter.

Thanks,
Angela

ATCH #13

RMS Voltage Minute Histogram Report

START: Jun 21, 2006 15:20:43
STOP: Jun 27, 2006 14:25:44
Duration: 5 Days 23:05:01
Firmware Version: 2.41, Unit Type: IV/600
Software Version: 1.84, Serial No.: 15097
FILE NAME: W:\RVM Data\PMI\Gila Bend\America's Inn Scott's at SES, 6-28.isf
VOLTAGE SCALE FACTOR: x1.00
CURRENT SCALE FACTOR: x1.00
CURRENT RANGE: 1000 Amps
STRIPCHART INTERVAL: 1 Minute

Voltage	Minutes		
Volts	Channel	Channel	Channel 3
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
197	0	0	0
198	0	0	0
199	0	0	0
200	0	0	9
201	0	0	74
202	0	0	216
203	0	3	669
204	0	47	892
205	0	232	1634
206	0	621	1474
207	0	1207	1115
208	5	1605	892
209	96	1556	675
210	436	1108	525
211	1191	1136	84
212	1574	649	3
213	1796	168	0
214	1086	33	0
215	1108	0	0
216	843	0	0
217	354	0	0
218	66	0	0
219	28	0	0
220	0	0	0


RMS Voltage and Current
Max V
Max I
Ave V
Ave I
Min V
Min I
Ch1 A
4 2 0 -2 -4
Ch2 A
4 2 0 -2 -4
Ch3 A
4 2 0 -2 -4
Ch1 V
200 150 100 50 0
Ch2 V
200 150 100 50 0
Ch3 V
200 150 100 50 0
14 Wed
15 Thu
16 Fri
Jun 2006

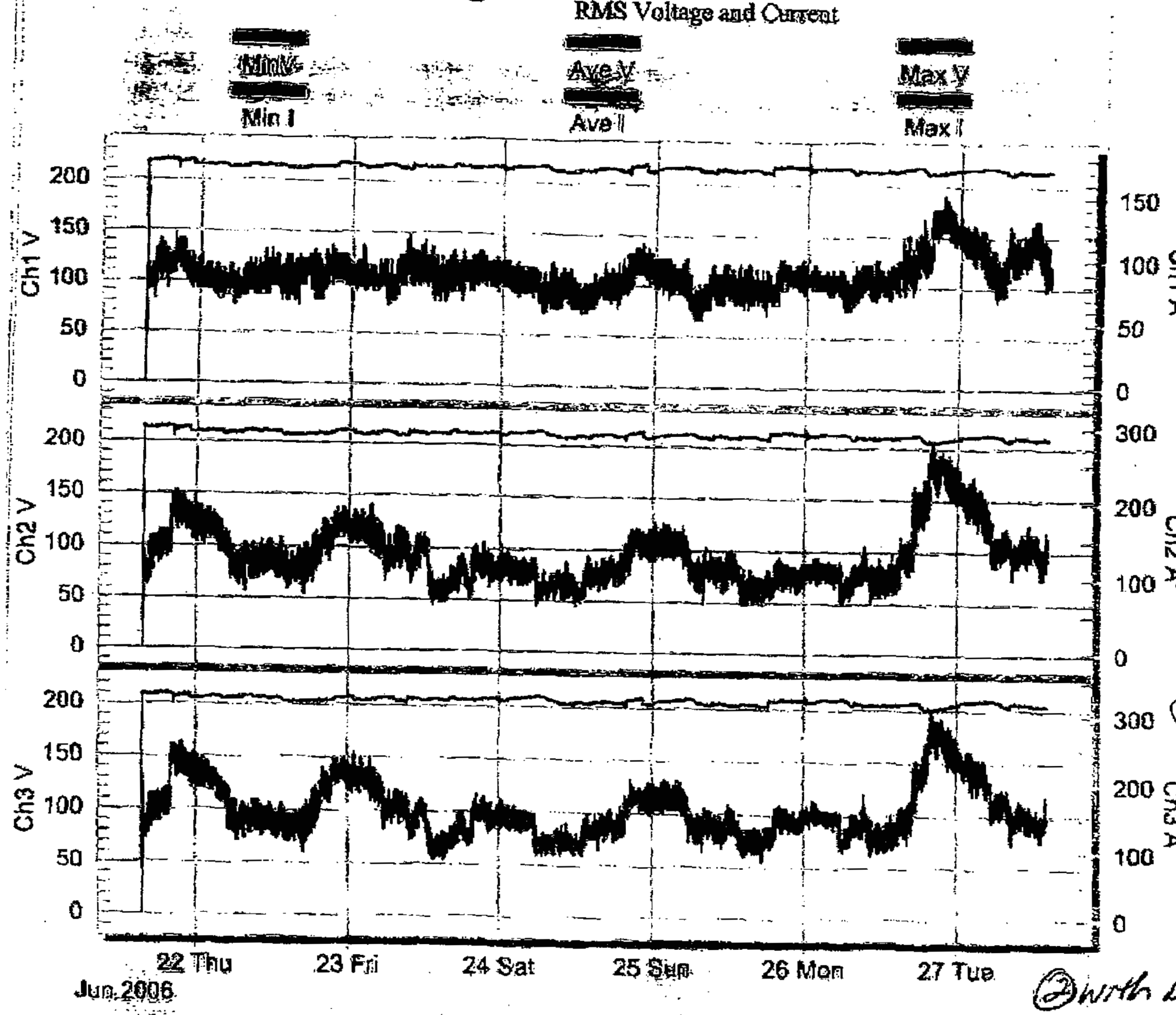
Header Report

RMS Voltage Minute Histogram Report

START: Jun 21, 2006 15:20:43
STOP: Jun 27, 2006 14:26:44
Duration: 5 Days 23:05:01
Firmware Version: 2.41, Unit Type: IV/600
Software Version: 1.64, Serial No.: 16097
FILE NAME: W:\RVM Data\PMI\Gila Bend\America's Inn Scott's at SES, 6-28.isf
VOLTAGE SCALE FACTOR: x1.00
CURRENT SCALE FACTOR: x1.00
CURRENT RANGE: 1000 Amps
STRIPCHART INTERVAL: 1 Minute

Voltage Volts	Minutes Channel	Channel	Channel 3	
0	0	0	0	
1	0	0	0	
2	0	0	0	
3	0	0	0	
197	0	0	0	
198	0	0	0	
199	0	0	0	
200	0	0	9	
201	0	0	74	
202	0	0	218	
203	0	3	569	
204	0	47	692	
205	0	232	1634	
206	0	621	1474	
207	0	1207	1115	
208	5	1805	992	
209	98	1555	876	
210	436	1108	525	
211	1191	1136	84	
212	1574	649	3	
213	1796	188	0	
214	1085	33	0	
215	1108	0	0	
216	843	0	0	
217	354	0	0	
218	66	0	0	
219	28	0	0	
220	0	0	0	
	8585	8584	8584	Total minutes
	0	2010	6105	Minutes less than 208Voltz
	0%	24.6	71.1%	Percent of time less than 208 Voltz

AMERICA'S INN @ SES

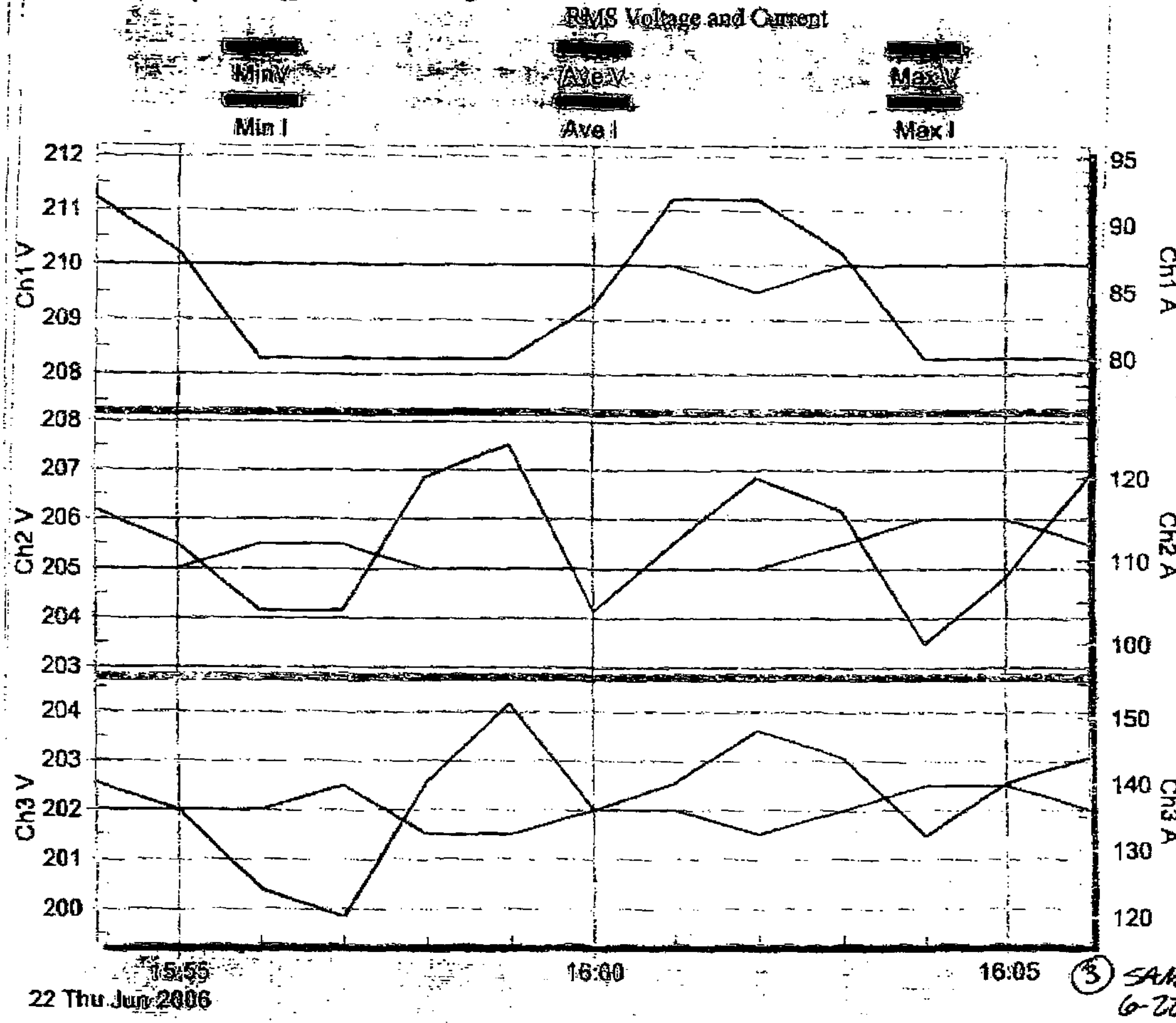


06/22/06	16:00:00
Ch1 V	
Ch 1 ave:	210 V
Ch1 A	
Ch 1 ave:	84 A
Ch2 V	
Ch 2 ave:	205 V
Ch2 A	
Ch 2 ave:	104 A
Ch3 V	
Ch 3 ave:	202 V
Ch3 A	
Ch 3 ave:	136 A

• CHANCE
to BALANCE
LOAD AMPS
BETWEEN PHASES

(2) WITH DATA LIVE AT
6-22-06 4:00pm

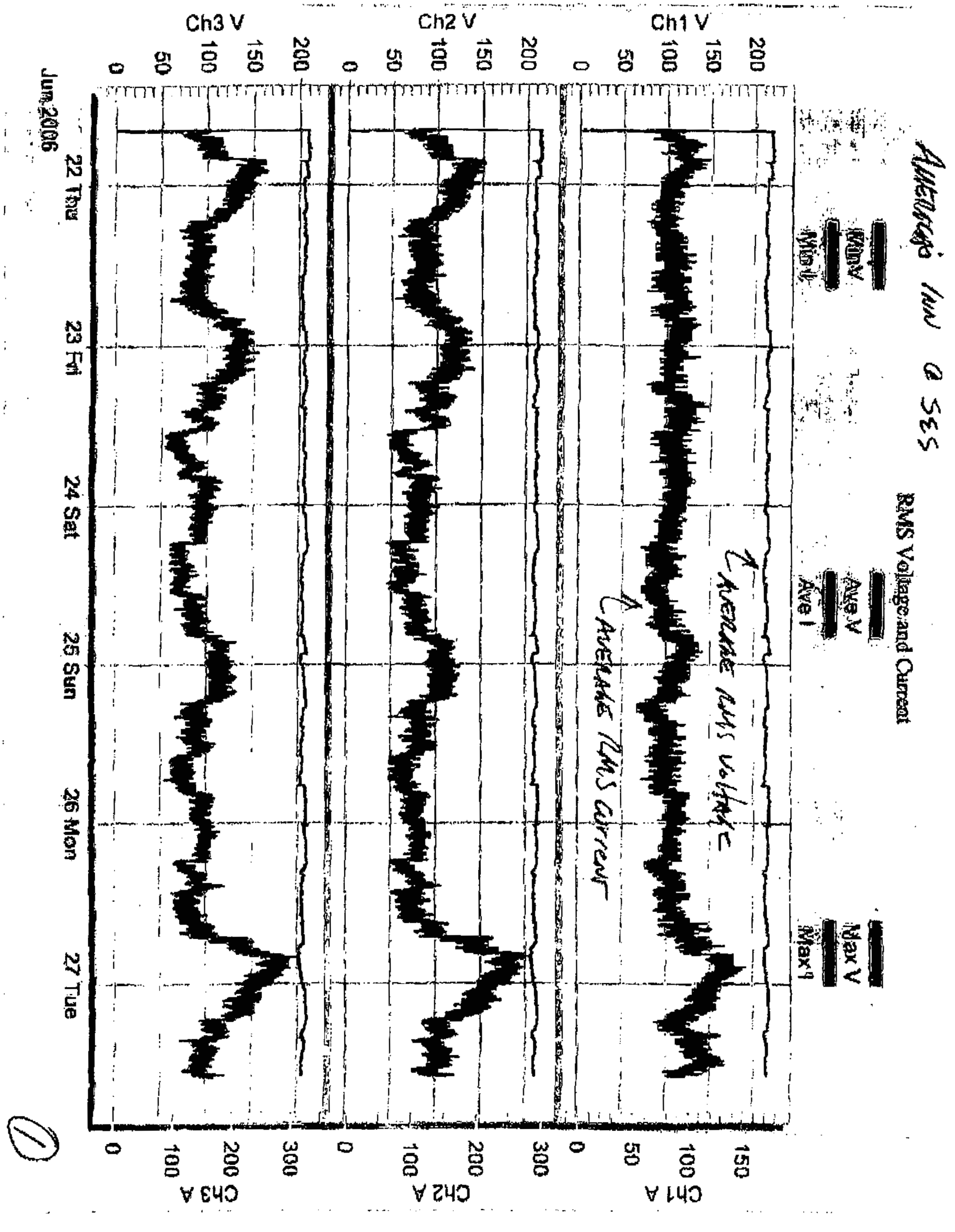
AMERICA'S INN @ SES



06/22/06	16:00:00
Ch1 V	
Ch 1 ave:	210 V
Ch1 A	
Ch 1 ave:	84 A
Ch2 V	
Ch 2 ave:	205 V
Ch2 A	
Ch 2 ave:	104 A
Ch3 V	
Ch 3 ave:	202 V
Ch3 A	
Ch 3 ave:	136 A

3 SAME DATE + TIME
6-22, 4:00pm
ZOOMED IN

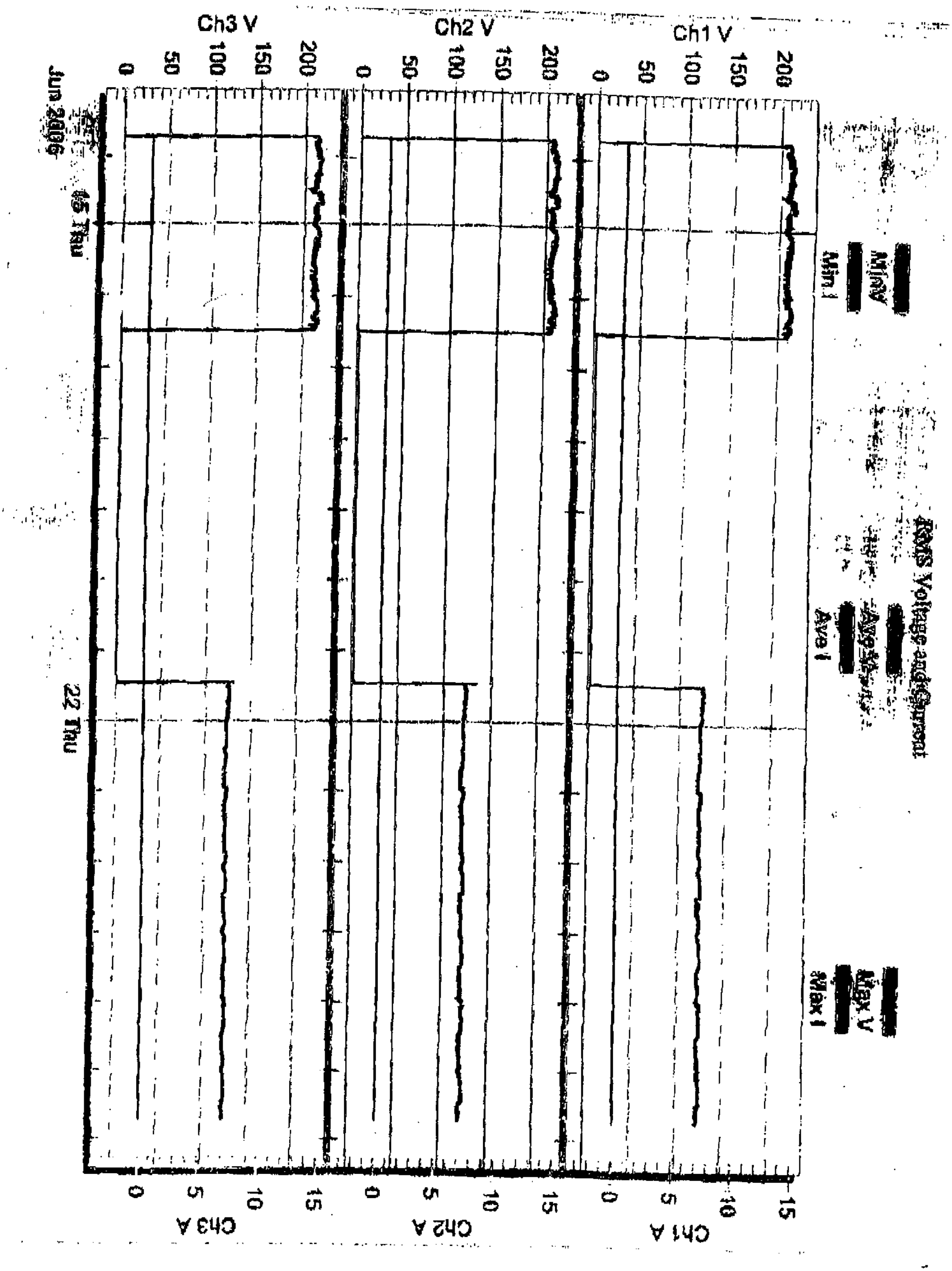
07/18/2006 01:57 NO.327 P06



06/30/2006 06:54 NO.649 P02

Header Report

START: Jun 13, 2006 17:08:19
STOP: Jun 27, 2006 14:14:32
Duration: 13 Days 21:06:13
Firmware Version: 2.41, Unit Type: iV/600
Software Version: 1.84, Serial No.: 16093
FILE NAME: W:\RVM Data\PMI\Gila Bend\America's Inn Greg's Recorder, 6-28.isf


RMS Voltage and Current
Min V
Min I
Ave V
Ave I
Max V
Max I
Ch1 V
Ch2 V
Ch3 V
0
50
100
150
200
Ch1 A
Ch2 A
Ch3 A
0
5
10
15
Jun 2006
15 Thu
22 Thu

Header Report

START: Jun 13, 2006 17:08:19
STOP: Jun 16, 2006 11:47:55
Duration: 2 Days 18:39:36
Firmware Version: 2.41, Unit Type: iV/600
Software Version: 1.84, Serial No.: 16093
FILE NAME: W:\RVM Data\PMI\Gila Bend\America's Inn GB 22.isf

VOLTAGE SCALE FACTOR: x1.00
CURRENT SCALE FACTOR: x1.00
CURRENT RANGE: 1000 Amps
STRIPCHART INTERVAL: 1 Minute

ABNORMAL VOLTAGE: Events reported
SIGNIFICANT CHANGE: 351 events
No Flicker events reported.
No Loose Neutral reported.
EVENT CHANGE: 1600 events

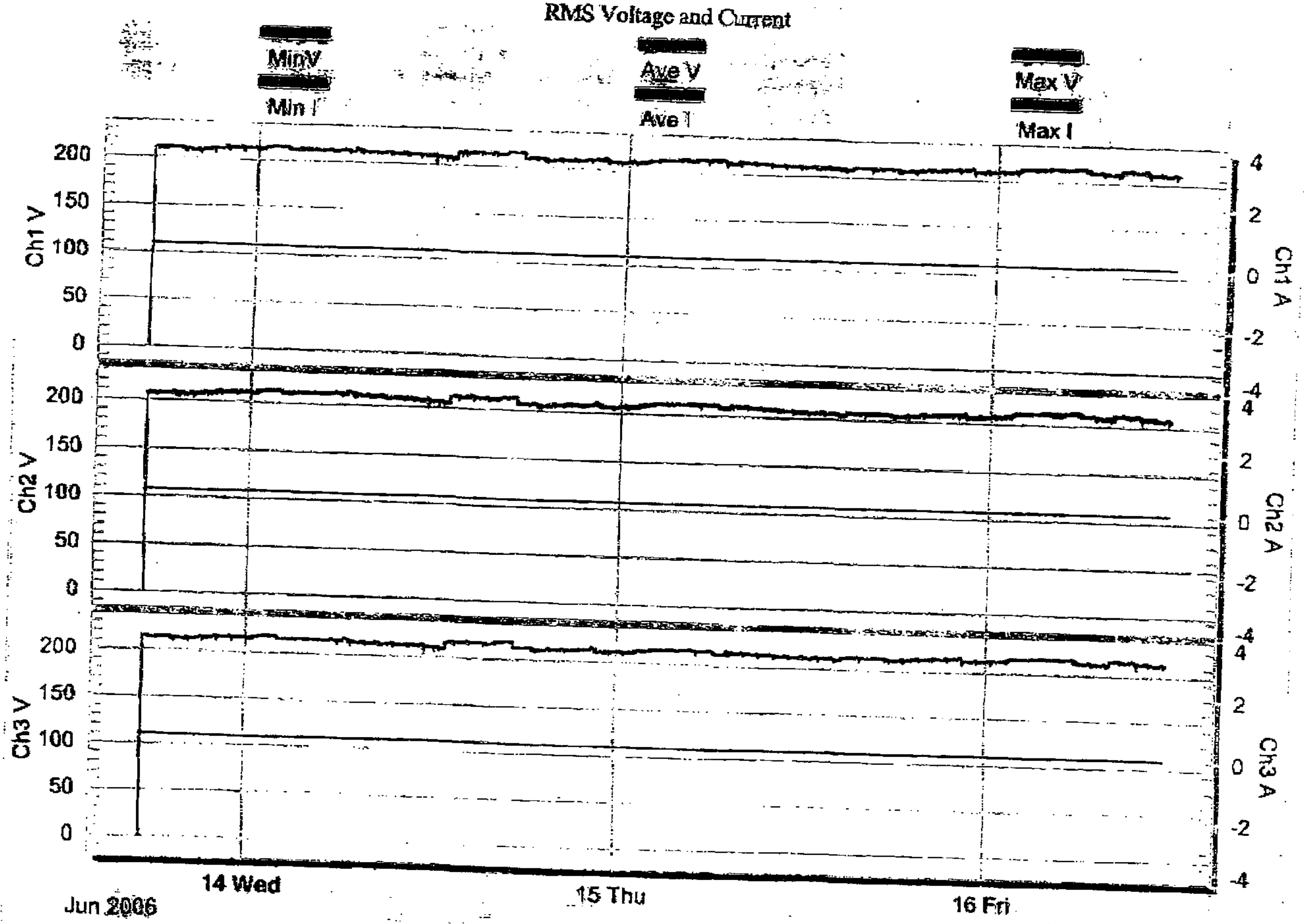
RMS Voltage Minute Histogram Report

START: Jun 13, 2006 17:08:19
STOP: Jun 16, 2006 11:47:55
Duration: 2 Days 18:39:36
Firmware Version: 2.41, Unit Type: IV/800
Software Version: 1.84, Serial No.: 16093
FILE NAME: W:\RVM Data\PMI\Gila Bend\America's Inn GB 22.isf

VOLTAGE SCALE FACTOR: x1.00
CURRENT SCALE FACTOR: x1.00
CURRENT RANGE: 1000 Amps
STRIPCHART INTERVAL: 1 Minute

Voltage Volts	Channel	Minutes Channel	Channel 3
0	0	0	0
1	0	0	0
2	0	0	0
200	0	0	0
201	0	0	0
202	0	3	0
203	0	107	0
204	0	360	0
205	0	808	0
206	164	543	0
207	552	402	0
208	868	417	0
209	659	586	9
210	485	514	88
211	577	222	400
212	427	37	839
213	181	0	771
214	63	0	484
215	23	0	664
216	0	0	432
217	0	0	220
218	0	0	41
219	0	0	45
220	0	0	6
221	0	0	0
222	0	0	0
223			

3999 3999 4000 Total minutes
716 2223 0 Minutes less than 208 Voltz
17.9% 55.6% 0% Percent of time less than 208 Voltz


RMS Voltage and Current
MinV
Min I
Ave V
Ave I
Max V
Max I
Ch1 V
Ch1 A
Ch2 V
Ch2 A
Ch3 V
Ch3 A
Jun 2006
14 Wed
15 Thu
16 Fri

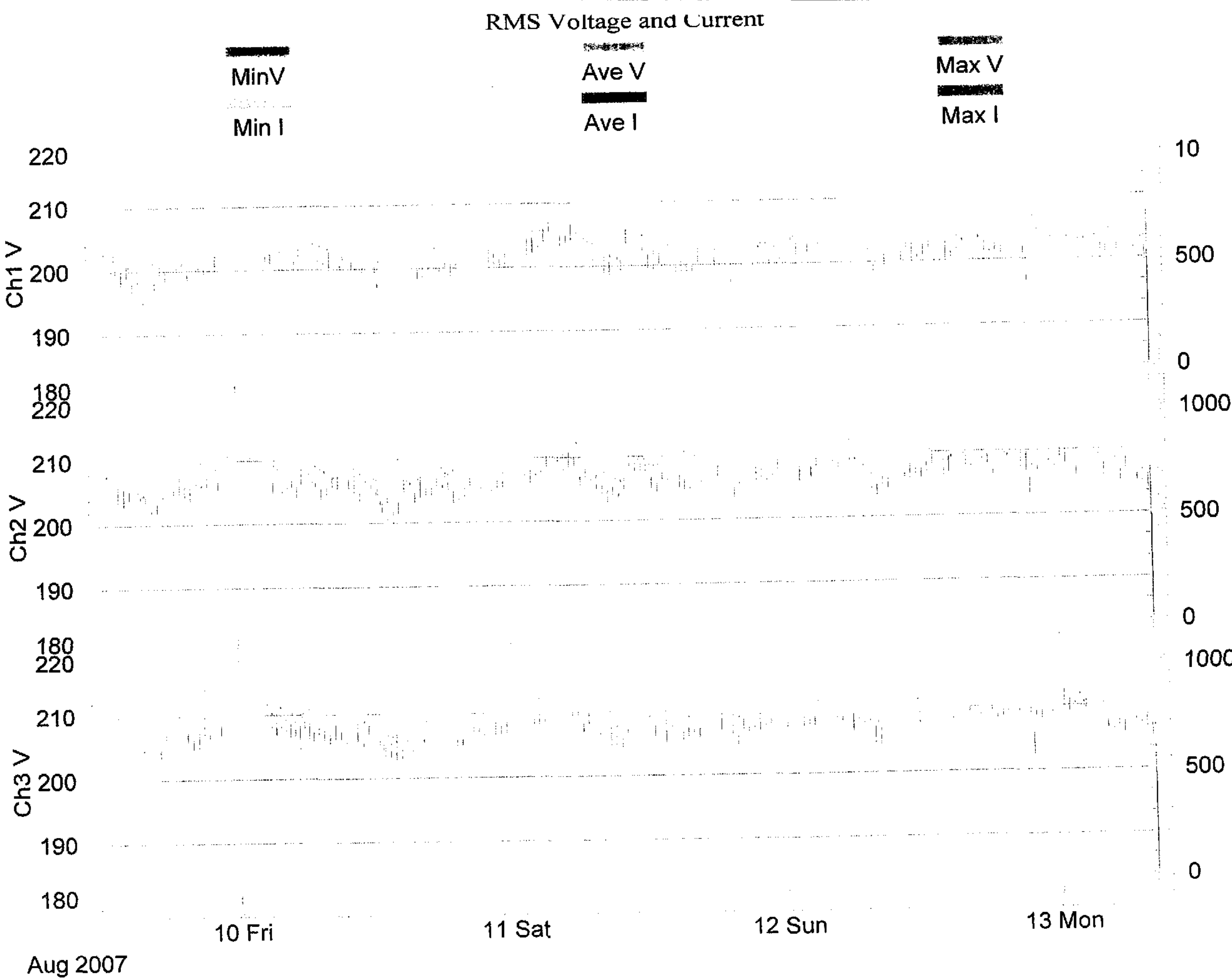
Additional Analysis of Data from Voltage Minute Histogram Reports

6/13/2006 6/16/2006 Channel #1	6/13/2006 6/16/2006 Channel #2	6/13/2006 6/16/2006 Channel #3
164• + 532• + 002 [redacted] 863• + 659• + 485• + 577• + 427• + 181• + 63• + 23• + 010 3,999• T	5• + 107• + 350• + 303• + 543• + 402• + 006 [redacted] 417• + 586• + 514• + 222• + 37• + 011 3,999• T	9• + 53• + 400• + 839• + 771• + 434• + 664• + 432• + 225• + 41• + 46• + 5• + 012 4,000• T

6/21/2006 6/27/2006 Channel #1	6/21/2006 6/27/2006 Channel #2	6/21/2006 6/27/2006 Channel #3
5• + 93• + 436• + 1,191• + 1,574• + 1,796• + 1,086• + 1,103• + 843• + 354• + 56• + 23• + 012 8,535• T	0• + 47• + 232• + 621• + 1,207• + 005 [redacted] 1,305• + 1,555• + 1,103• + 1,135• + 649• + 133• + 53• + 012 8,584• T	0• + 74• + 213• + 689• + 992• + 1,634• + 1,474• + 1,115• + 008 [redacted] 992• + 473• + 525• + 64• - 3• + 013 8,584• T

ATCH #16

ATCH #17



RMS Voltage and Current
MinV
Min I
Ave V
Ave I
Max V
Max I
Ch1 V
220
210
200
190
180
Ch1 A
10
500
0
Ch2 V
220
210
200
190
180
Ch2 A
1000
500
0
Ch3 V
220
210
200
190
180
Ch3 A
1000
500
0
10 Fri
11 Sat
12 Sun
13 Mon
Aug 2007

APS MEDIATION
JOHN LaPORTA, MEDIATOR
LYNN WHEELER, AMERICA'S CHOICE INN & SUITES
ANGELA ALLISON, SENIOR CUSTOMER ADVISOR, APS
KEN WOLFE, SOUTHWEST VALLEY MANAGER APS
CHRIS WEATHERS, SENIOR CONSULTING ENGINEER, APS
TRISH MEARE, APS

JOHN LaPORTA (JL): My name is John LaPorta. I am a Public Utilities Consumer Analyst with the commission. I am not here to represent any party to this mediation. Okay. I am not here to offer suggestions or opinions of any kind. I am just here to mediate, okay. The parties for today's mediation are Mr. LW Wheeler who represents America's Inns and Suites in Gila Bend Arizona. Is that correct Mr. Wheeler?

LYNN WHEELER (LW): America's Choice.

JL: America's Choice. Okay.

LW: America's Choice. That's right.

JL: Okay and his contention is that APS, his electric provider is not supplying him enough or proper amount of voltage to run his business.

LW: Correct.

JL: Correct. Okay. Representing APS is Angela Allison who is a senior customer advisor who works in the Consumer Advocate Office of APS. Also present is Mr. Ken Wolfe. Ken can you give us a reply on that.

KEN WOLFE (KW): Southwest Valley, manager for APS.

JL: Okay, and you sir?

CHRIS WEATHERS (CW):Chris Weathers, I am senior consultant engineer.

JL: Okay. And also present for today's mediation is a co-worker of mine who is sitting in the back of the room, LW Combs (laughing) who is here just to represent and also observe today's proceedings. Okay. I will ask everybody before they speak and I am going to ask Mr. Wheeler to speak first, okay. To identify themselves for the tape-recording purposes, so we know who they are. If we have a demonstration, I ask you to visualize that because again you are going to be taking into a tape recorder, okay, so hopefully we can all see what is going on. So, at this time, I will turn the floor over to Mr. Wheeler and I will let him explain his situation and what he is looking for to resolve this. Mr. Wheeler?

LW: Yes. My name is Wheeler, America's Choice & Suites, property manager and park owner. The only thing I am looking for is to get the proper voltage that I am supposed to be getting, which it has not been happening that way. I do understand, I have brought; this is just a short summation by this gentleman here.

JL: And who is that Mr. Wheeler?

LW: This is Geiger Electric who certified, and as far as I can make out, his qualifications are very good and I think he sums it up there pretty much that the equipment I have will not operate.

JL: These are the electricians, Mr. Wheeler?

LW: Yes. mmm-hmm….I meant yet to make copies of it, but my…

JL: That's okay.

LW: …copier ran out of ink.

JL: We can make them for you; there's no problem. All right.

LW: And I don't have a letter from him. But I can give you his…

JL: He's got his address and phone number down here in the bottom too.

LW: Yes, mmm-hmm.

JL: So it's on the bottom of the letterhead.

LW: Yes.

JL: His name is on (inaudible) there.

LW: Okay, Electrical Decisions Incorporated and that is Michael Burgett.

CW: I know, Michael Burgett.

LW: You're familiar with him?

CW: Yeah.

LW: He also was referred to me as being very competent.

CW: He is.

LW: And he's a real nice guy on top of that.

JL: Did you want us to supply his phone number?

LW: The phone number on that is 602-275-4365. Now, in speaking with Mr. Burgett, he was going to try to get out there this last weekend but he could not make it. He said, "go ahead" and he'll get out there as soon as he can and he can go over what the electrician has suggested. He said all of them, all the suggestions he has made are pretty much in line with what you are talking about as far as raising the voltage up and to cut to the quick here, in discussing with Mr. Geiger, he said there's three different ways that you can accomplish what you want here. Number one is to use a step-up transformer.

JL: Mmm-hmm

LW: Is I believe the correct term on that which is putting a transformer below each circuit breaker box to bring the voltage up to what we need.

JL: Mmm-hmm

LW: Now, he also, excuse me, he also went through everything I have got inside there.

JL: Okay.

LW: And he said he wouldn't have be done that way, but he said the way it is configured, he said you could put in 240 and it would not be, the expense that I had told you before. And he said I apologize for that but he said just from what you told me and to make a short comment there, he indicated that all the boxes were connected with conduit so that you could go through and rearrange the different circuits there that need to be changed out. The third, he said, would be to bring the transformers off the pole, bring them down, put them on the ground. He says that way you would have controlled the actual amount of power coming in because they do have taps on them. So there is, other than APS to bring the voltage up, that's the three suggestions that are being made.

JL: Would somebody from APS like to reply that?

KW: Some, just a couple, I've got some questions.

JL: Ken, identify yourself.

KW: I'm Ken Wolfe with APS.

JL: Okay.

KW: Do you know, and this is excellent. This is the kind of stuff that we are looking for in the consultants and from the engineering, on your equipment on your side of it, because we are not...APS is not familiar with all the different pieces of equipment that you have operating at your facility. The units that we are talking about, you are having problems with, is it the window units? Is it the air conditioning only, or what pieces of equipment seem to be causing the most problems for you?

LW: The air-conditioners and the ice machine.

KW: Okay. The AC units and if I remember from previous conversation you said you have 41 of those?

LW: No, I have 56, 58.

KW: 58, huh?

LW: 58, around there.

KW: Okay. 58 AC and those are the under the window kind of units.

LW: Right. Wait a minute. Let me count up here right quick, so I am not misleading you.

KW: That's okay. All right.

LW: 72 to be exact.

KW: 72 unit? And now these are all...they're the same type of unit?

LW: Yes, mmm-hmm.

KW: And they're all, what is the voltage of them?

LW: They are set up for 208-230.

KW: Okay. 208-230. Now, let us talk about that just a second. When we say 208-230, there's a couple of designations that are very confusing in the industry. And we just want to make sure and clarify what it is. And we may, you may or may not know, there is a kind of unit, when you designate 208-230, that means that they operate at 208, or they operate at 230. That's one generalistic way of describing 208-230 unit. Or, which means, in that situation, is that you have the option as an owner to connect them to your wiring scheme at 208 volts or at 230 volts. So, you actually have to choose which voltage you want. Or they're rated at an operating range of 208 to 230. And it is real important to know which type of scenario we are dealing with there.

LW: All right. You're dealing with a scenario of 208 to 230. The operating…

KW: The range, the operating range of 208 to 230?

LW: That is correct.

KW: Okay. So, I am asking so we can get this … we're all on the same page.

LW: Yes, that is clear.

KW: Okay, 208-230 operating range and that's at single phase?

LW: That is right. That is on a single phase. I only have one unit on three phase and that is my washers, commercial washers. That's on three phase.

KW: All right. I just want to make sure we capture all this. So….

LW: Right. Mmm-hmm.

KW: The…so we got 72 AC units, in the 208-230 single phase, and that's the operating range. And you mentioned you had an ice machine?

LW: Correct.

KW: So, ice machine. And that's how many units are those?

LW: Just one.

KW: One. And what is the…voltage?

LW: Basically, the same thing.

KW: A 208.

LW: 208.

And it's real important to understand. Is it the range 208-230?

LW: Range 208-230.

KW: Okay. And is it that also single phase?

LW: Yes, mmm-hmm.

KW: Okay. And then you mentioned a…you did say you had a piece of equipment that is operating at three phase?

LW: Yes, the washers.

KW: The washers?

LW: The washers. Mmm-hmm..

KW: Right.

LW: They're Hitch... and I cannot spell that for you.

KW: That is okay. And how many of those units you have?

LW: Two.

KW: Two. And those are…those are real…those are 208 volt, three phase units?

LW: Right.

CW: Or does it say 200 volts on the nameplate?

LW: No, 208.

JL: Okay.

LW: Let me clarify, and I think I see where you are going here. Somebody had mentioned, somebody had called and I do not have his name. He caught me at a bad time, and I was doing something else. These units do not have taps on them per se.

KW: Right. Okay that's important to know.

LW: The…in talking with the compressor, motor people, he says they don't have taps. He says, "We build those in." That's why they've got the range of 208 to 230.

KW: Right.

LW: And he said, "We understand that you are going to have spikes. And we build in for that. In other words, it can spike down, it can spike up." He said, "It's better, much better for spike up. They handle that, or tolerate that better than to spike down." But, he said, "There is no problem with them spiking down and coming back up." He said, "The problem, from what you are telling me lies in the time that they are below that 208 voltage.

KW: Right.

system, the motor, the NEMA standard nameplate voltages will be 460. On a 2400-volt system, the NEMA voltage will be 2300. On a 240-volt system, the NEMA voltage would be 230. This is the motor nameplate. On a 208-volt system, the NEMA voltage on the nameplate, the standard voltage will be 200. So, what you notice is the voltage on a motor nameplate is always a little bit less than the nominal of voltage. In fact, you go back 40 years ago and voltages on motors at 460, was 440, because they used to park the transformers in the back of the building and long run a cable, on the voltage drop. If you took a national average, the voltage is around 460. Now, we are putting unit stations right in the building, shorter feeder lengths, and so if you took a national average, it is around 460.

So, NEMA stands for National Electric Manufacturers' Association. And one of the requirements to meet NEMA standards is that a motor must last and have a satisfactory life for plus or minus 10% voltage. In other words, you could have 460 volts minus 46 volts, and that motor should last its normal number of years. So, to meet NEMA standards, a motor should operate plus or minus 10% and not have problems. Now, a motor with 208, slant 230, is not a NEMA standard motor. They are out there in the industry, but it is not a NEMA standard motor. And what happens is with the utilities when you look at the Arizona Administrative Law Code, it says we must meet ANSI standard 84.1 and range A and ANSI standard 84.1 says, "Utilities should maintain voltage within plus or minus 5%." So, plus or minus 5% of 208, and they say, for... and they don't define how long, but for periods of time, utility can be in range B and the voltage could be as a low as 91.7% of the 208 volts. And yet that is not considered abnormal or bad voltage.

Now, utilities try to get out of range B and get it back into range A and maintain plus or minus 5%. I put together just a little handout last night that maybe you can share with Mr. Wheeler. With trying to, you know, put this in writing, and I see Mr. Wheeler, you have what is called the SBIMA curve. And the SBIMA curve basically says, you know, you can operate outside of a range for very short periods of time, microseconds or milliseconds and not have a problem. That mainly pertains to computers. But if the low voltage or the high voltage lasts for too long, you can have problems.

Now, it turns out high voltage can be just as bad as low voltage. Normally, as you lower the voltage to the motor, it draws more current and that is bad for it because there is more heat and that takes life out of the insulation system, causes the motor to fail. Normally, when you raise the voltage a little bit, it draws less current, except if you raise it too much, and then it actually starts drawing more current. The core saturates. In order to get the flux, it draws even more current, and so both high voltage and low voltage can be bad for a motor. But NEMA standards and for the vast majority of motors say that you should be able to operate that motor with no loss of life, plus or minus 10%. If it met NEMA, National Electronic Manufacturers Associates Standards.

So, that is the vast majority of motors meet NEMA standards. Now, they've got this motor out there, 208 slant 230, and like Ken said, you know, some motors means

230 but no lower than 208. If you are lower than 208, you can expect problems. Other motors attempt to sort of be somewhere in between and what happens is that if you're on a 208 volt system and the voltage happens to be on the low end, you are gonna see high current. So, as a power quality engineer in an earlier job I had with APS, I probably had, over that period of time, 15 calls on a similar problem. We have a 208 slant 230 volt motor. It's tripping out all the time, on overload. It is burning up, and the solution, I'm just talking from an engineering standpoint, is to either replace those motors with 200 volt motors, which will run just fine on a 230, 208 volt system. You *could have 10% below 200 volt.*

In other words, you could have 180 volts on the utility system, and that 200 volt motor on a 208 volt system, if it met NEMA standards, would operate just fine. But you put a 208 slant 230 on a 208 volt system, and if it's a little bit on the low side, but still within acceptable range, you can expect to have serious problems. So, as you talk about the solution, one way is to convert your system to a 240-volt system, and then, certainly, a 230-volt motor on a 240-volt system would not have problems. Another way is to use what's called a buck-boost transformer. And it's cheaper than a normal transformer because you don't have two windings. It's an autotransformer.

And I'm thinking if all the units are on a single feeder, or may be three or four feeders; it's not like you would have to put one on each unit, but back where you have your service entrance section. An electrician could install a buck-boost transformer and set it on a tap that would raise the voltage and this, then would solve the problem of the motors overheating because they are drawing too much current at low voltage. So, what I'm saying is that there have been lots of problems in the industry and NEMA is gonna address this. They just have not gotten around to writing on this specifically, but it is noted that this is...and if you go out on the Internet and surf the Internet, you'll see lots of documents talking about this problem. And I cannot tell how many ice cream shops, other places.

And what is significant to me is you have not had problems with your three-phase commercial washers, which I would venture to say, if you looked at the nameplate on the motor, it says 200 volts. And, you know, they're lasting just fine. But I would think the ice machine, which says 208 slant 230 on the nameplate and all the window units that say 208/230 would have problems on any Utility's 208 volt system. Because, you know, the voltage tends to be high at night, as the load goes down, less current, less voltage drop. During the day, it tends to get low, as load turns on, more of a voltage drop. So, the voltage is gonna fluctuate every second, every minute of the day and what Utility tries to do is to keep in a plus or minus 5% band. Now, that range A doesn't pertain to transients. For example, every time you start one of your air conditioners, the voltage is going to drop. I mean, I do not know if you have ever noticed at home. When my wife turns on the iron or the heat pump in my house comes on, I see the lights dim.

LW: Yeah.

CW: So every time when one of your window unit turns on, there's a normal six times rated current, in rush current, that will cause the voltage to go even lower than what is range A. It lasts for a few seconds until the motor accelerates up to speed and then the voltage goes back up. That should normally not effect the life of the motor in any way. Now, if the voltage drop is too much, it can cause the voltage to drop so low that motors will drop out. And Utilities, actually working with our customers, we do what's called a Flicker study. If our customer is gonna put a large motor on our feeders, we'll say, "You've got to limit the starting current to this many amps. Otherwise, the voltage drop, the transient voltage drop that you cause…put on our feeder, will cause other customers to have problems." And so, we insist, that they draw no more than a certain amount of starting current.

So, some of the voltage transients are actually probably caused from one of your 72 units. Every time one of those units turns on, there is an inrush at six times rated current. The voltage will certainly drop, for, you know, half a second, until the motor accelerates up to speed. So a lot of those voltage transients are coming just from starting your own motors. But, looking at the waveforms that Ken had, it appears we're operating at a pretty good voltage. And the motors should not have problems with that voltage. Now, if we were to raise the voltage, at night, we could have just the opposite problem. We could have too high of a steady state voltage, that would cause your motors to draw, like I say, normally the current will go down as the voltage goes up and then you reach a point, and suddenly, there's a lot of current flowing. Actually, much more than with current at low voltage, and you can quickly burn out a motor there. So, in looking at the voltage that Ken has, it seems to me it's acceptable voltage within the administrative requirements of the ACC. There's actually a law that says we will try to maintain voltage within 4.1. (inaudible) 4.1. It appears to me that that voltage looks fine and a 200volt motor, would not, on a 208 volt system, which is what should be used, would not have problems with that…that voltage. But I can well believe, because I've seen it, you know, at least 15 times in my carrier at APS, people with 208 volts, slant 230 volt motors, which is not a NEMA standard. You won't…that is not…that doesn't meet any standard whatsoever. It's built. It is available commercially. You can go out and buy them. You have them.

But they tend to have problems on a 208 volt system. They tend not to have problems on a 240 volt system. So one of the suggestions to convert to 120-240, would probably solve that problem. But that maybe an expensive solution. I'm wondering, depending on how your feeders are configured out of your service entrance section, if you only have, lets say, two or four feeders that feed all 72 units. Maybe one feeder feeds 12 or 20. Another feeder feeds another 20. It's just a buck-boost transformer on that feeder, raising the voltage to just the window units, wouldn't that solve the problem? Without having to replace all the motors in the window units?

LW: I can't answer that.

CW: But Mike Burgett is a good engineer. I can tell…I know. I've worked with him on lots of things. And…

KW: Maybe what we do, as to making schedules match and everything, as to where there would be...if Mr. Burgett...am I saying his name right?

CW: Yes, Burgett.

KW: Is going to be coming out to your property and taking a look at it? Perhaps after he reviews it or...I don't know, if Chris is...we'll have to make it out. But we can certainly have a conversation between the two of them and work our way through this? Because we definitely want to get this solved, there is no doubt about that.

LW: Well this is something. To be honest, I spoke with Mr. Burgett yesterday and I told him, I said, "You know, I don't want to hurt your feelings Mr. Burgett, but it seems like an electrical engineers, attorneys, doctors, there is, you take one problem, they've got three different answers. I mean, you bring three different, which ever of them in and none of them will agree. Why is this?

CW: You know, our senior vice-president in charge of Palo Verde said his daughter just graduated from law school. He said, "I don't know where I went wrong, but I hope you don't put engineers in the same bucket with lawyers." You know, as an engineer, we just try to state the facts and not give you three different answers. There is only one right answer. But you know, motors are...utility systems are designed to have varying voltage. There's no way a Utility can maintain constant voltage because...

LW: I understand.

CW: as people turn on things, you know, the voltage drops and so forth. Likewise, I mean every time current flows in a system, the voltage drops. So, every time you start one of your window units, the voltage does drop until that unit accelerates and is running at normal speed. And that's just normal. I can tell you 65% of all the megawatts we sell go out there to run motors. So, motors have to be designed to operate within a range of motors. And the standard for this country, the NEMA standard is plus or minus 10%. Every NEMA standard motor should be capable of operating 10% below its nameplate voltage, and 10% above its nameplate voltage without any loss of life. That is the NEMA standard.

Now, you happen to have a motor that is not a standard voltage. It is not a NEMA standard. If you go out on the Internet and look at NEMA standard voltages, you will see that the standards are the kind of voltages I have up there and you will notice that the voltage on motor nameplates is always a little bit lower than the nominal voltage of the system. Because motor manufacturers realize that the voltage out by the terminus of the motor will be less than the voltages at the transformer. That motor voltage is a full load nameplate voltage and so when you turn the motor off, the voltage tends to go up. And then when we turn the motor on, it tends to drop a little bit. A 200 volt motor on a 208-volt system would run just find at 180 volts, f we were that low. Which we would not want to be that low, but that motor should last its normal life. Now anytime a motor draws more current than rated current, the temperature goes up and the rule of thumb I remember is for every 10-degree increase in temperature centigrade, the life of the insulation goes down by one half. And, let me ask you, when you replace those motors, are you rewinding them and buying new motors?

LW: New.

CW: New motors

LW: New.

CW: You know, unfortunately, you would be much better off. The next time a motor fails, you would be much better off replacing it with the 200 volt motor and not a 208 slant 230 volt motor. A 200 volt motor would be a standard NEMA motor and…

LW: But these…that is not applicable in this situation, because they don't have a variance. I mean, you've got to buy what was in there. They do not make a compressor.

CW: That particular manufacturer does not make…

LW: Yeah.

CW: …a replacement motor?

LW: I mean, you've got Amana and you've got Fedders. And I am having problem with Fedders right now in getting compressors, because they stopped making that compressor.

CW: Okay.

LW: So, now, I've got to find one that will fit in there. But it…but, let's …I'm somewhat familiar with NEMA, but comes from ANSI, basically range A service voltage range is plus or minus 5% of normal, right?

CW: Yes, of 208.

KW: Mmm-hmm.

LW: 208. Well, range A, the currents of services voltages outside of these limits should be infrequent.

CW: Now, if they're talking about steady state voltage, the steady voltage, but every time you turn on a motor, that motor is going to drop well, and that ANSI 84.1 does not pertain to transient voltages and every time you start a motor, it typically draws six times rated current, and the voltage will drop way out of range B but then come back up. But that kind of momentary voltage, at the starting of a motor should not effect the life of a motor. It is such a short duration that it does not affect the life of the motor.

LW: It will affect the life of the motor as long as I am basically at 208 on a continuance.

CW: Well 208 plus or minus 5%.

LW: And this is his and this is yours. How many days here...

JL: Describe what we're looking at for the tape.

LW: This is a RMS voltage and current...

CW: Right.

LW: It means (inaudible).

CW: Uh-huh.

LW: And you've got Thursday, Friday, Saturday, Sunday, Monday, and Tuesday.

KW: We're looking at...what's the dates on there? June of 2006? I'm trying to read upside down. it's at the bottom. Yeah, it's right there.

LW: Yeah.

KW: Okay.

LW: And as you see there, I have got one that's at 210.

KW: Uh, huh.

LW: The next one, for those five to six days, 205.

KW: Mmm-hmm.

LW: For this one, I am down to 202. Continually. Now, that's the average voltage. That's way below 208.

CW: Five, 95% of 208 volts is 197 volts. In other words, within range A, we can go down to 197 and that would be considered normal utility voltage, continuously...

LW: No, not continuously. Unless...

CW: Yes.

LW: This is off.

CW: That is range A. Range A is plus or minus 5% steady-state voltage. Now, 95% of 208 volts is 197.6 volts.

LW: How come it says infrequently here?

CW: What are you looking at here?

LW: Standard.

CW: Range A, the occurrence of service voltage outside these limits, they're talking outside the plus or minus 5%, so they're saying 197.6 would be fine, but now if you went to 195, you out of range A, and that should be infrequent. You could be to range B, and actually, range B, a utility could be in range B for four-five months and not be in disagreement with Arizona Corporation Commission requirements. But we try to maintain a plus or minus 5%. Now, we could maintain 197.6 and we are fully within ANSI 84.1. That...that would be nothing wrong with that.

LW: Well, there again, as I brought up, you got one engineer's opinion, and you got another engineer's opinion. You got certified electrician's opinion.

CW: Well, let me state...let me go back and restate, we do want to solve your problem, but I think we have a...a misunderstanding of what we are trying to do.

KW: You can see it says right here, for 208 volts, if the utility was down to 197.6, that would be okay. If we were as high as 218.4, if our...as long as our voltage stays between those two numbers, we are in range A of 84.1. And...now the NEMA standard says, you know, the motor should actually operate even lower than that, plus or minus 10%, so a NEMA standard motor would have no problems with this range of voltages. The problem is, is you don't have a NEMA-rated motor, and what we're trying to...cutting to the chase, the whole problem is you got a motor that really can't, doesn't do well at less than 208 volts. We all agree with that. The problem is, is that our system, and the way we are required to operate, plus or minus 5%, allows us to come down below, down all the way to 197.6, and be within that 5% range. So, whenever we drop down below 208, and it does happen, I mean, you've got, you've got graphs of 2006, and even our 2007 graphs show we are below 208, but within the 5% tolerance range. So, therein lies the problem. And I think what we have to get to is, okay, well, how do we fix that? And what we're trying to do... and you named off three good solutions. I think we've got... I think we need to go back to looking at the solutions, but before we get going to the solutions, we just all need to understand and acknowledge the fact that you have a motor that doesn't like operating below 208, but yet its within the 5% operating bands that we're required, as a utility to be within. And then acknowledge the fact that when we do drop below 208, it's gonna happen. And so what...then we have to move to one of the solutions to get your voltage up to where that motor will be operational.

LW: Fine.

KW: That is the bottom line.

LW: I ask you one question.

KW: Sure.

LW: Why can't you give me 210 volts all three these?

KW: It is not possible.

LW: Why not?

KW: On a constant basis.

CW: At night, because at night, the voltage could then go up even higher.

JL: Yeah.

KW: And we'd be outside of range A on the high side. It is not possible to do that. And this…this is on an average. And you'll notice, one of the reasons why you see different voltage levels from your different phases, is because you have your motors, and this is good to see, actually, that he looked at how you're balanced. Your references says you've got window units on B and C phase…we don't know what you label as A and B and C phase. These are just…we just connected the clamps to the wires. We don't know how these match up to what your electrician has labeled A, B, and C, inside your meter panel. But, what is very clear is, looking at these, is we can see that which phases, see, this is almost flat. That tells me that it is not getting…it's being impacted by motors being turned on and off. Whereas, this one is and this one is, so my gut feeling, and this is why we'd want to work with the electrician to confirm it, is we would venture a guess that most of your units are either here or here, And so you can see, as the motor…

CW: But even trying to change them around, you still have problem.

KW: Correct…

CW: With our…with our…

KW: So where I'm going is that, this is why this one seems to be a little bit higher and these two seemed to be fluctuating is because these are the ones that are experiencing the on and off starts of your motor throughout the day, as the units come on and off, so we are able to ascertain, a little bit of information. Now, why can't we keep them up there? Couple of reasons. One is that you can see the results of the effects of turning motors on and off. It draws them down automatically. We can't keep them up. Because on your side of the system, just the normal start and stop is gonna vary your voltage up and down. And then on the APS side of the system, we're also impacted by all the other people that we talked about on motor side. So, we try and keep within that 5% band. Now, then you get into that, okay, well how can you, keep it in the 5% band? And that's what utility looks at. We put all kind of devices on our system to try and keep this in that band, regulators, capacitors banks and so forth. And then, you as a customer have options available to you to keep your equipment within tolerance bands, based on the kind of equipment and motors you find inside your facility. That's what we're talking about here. I think we got two options. One was changing the voltage in the transformers to 120 to 240 volts, which will be compliant with the kind of motors that you have. It creates some other potential issues inside which we haven't talked by yet.

The other option is for the...what Chris described is a buck-booster. It's an internal transformer that you would install on your side of the meter panel that would directly boost the voltage on those circuits which the air conditioners are located, which would keep it up above 208. But APS cannot keep it above 208 because of all the other influences that are going to cause the voltage to fluctuate. That is why we do operate within that 5% band. And, my concern when we start looking at the chart is that we were gonna to be outside the bands. And we're pretty close. I mean, we get down to the bottom a couple of times, but we are not outside that band that would create an alarm in my mind that says we got a bigger system problem. So, everything...that's good news, in terms of I do not have other customers downstream of you complaining. Because if we were outside the bands, we'd be hearing from other customers as well. But, so that helps us isolate it to something at your location. So, that's what we're focusing in on. Okay, what can we do to get this up to where your equipment will work?

LW: Okay. I think we are all in agreement here. Forget the NEMA.

KW: Okay.

LW: NEMA does not come into play here.

KW: Well, you don't have NEMA rated motors, so they...

LW: I don't have NEMA rated motors. I can't get NEMA rated motors. They don't make NEMA rated motors for the product that I have.

KW: Okay. So we are dealing with the 208 to 230 volt.

LW: We're dealing with the 208, 230. Alright, you're saying, you can operate continuingly at 197.6 up to as much as 218?

KW: Yes.

CW: Mmm-hmm.

LW: I'm asking you why cannot we raise this up to 218, because you can operate there?

CW: Well, because if we did raise it up, then at night, there's a good chance it might go 240, some high…much, much higher voltage than we would like to see that could damage the motors on your washer, and affect other. And also the 120-volt circuits.

KW: Yeah, 120 volt circuit's up high enough.

CW: That'd be way too high and the things that you have plugged in there, incandescent lights would be going like flash bulbs. So it…the danger is that if we change the tap on our transformer, that there'd be times when the voltage would be way up above, maybe even range B for 84.1. So, we've got to be able to accommodate the voltage fluctuating up above and below.

KW: That's the problem

LW: Well…

KW: And that's when we talked about going to the 120, 240 volt system and what the impacts would be to the system or the other option is putting that buck booster on your equipment, to keep it up internally. That would just, you know, work inside your facility. Excuse me.

LW: Let me pose this question.

CW: Sure.

LW: Why did I start having problems three years ago? Why? The hotel is 15 years old. Why didn't we have problems 15 years ago?

KW: It might have been that our voltage was a little bit higher. You know, just marginally higher 15 years ago, and as Gila Bend grew and what not, it came down a little bit. It could be many other reasons.

LW: I'm gonna call you on that.

KW: How old are the units? Well, how old are the units? How old are these units that you're…

LW: The Amanas are five to six years old.

KW: About five or six years…

LW: The Comfort-Aires are three years old.

KW: Okay, so you have got two brands in there.

LW: Two brands.

KW: So, they're three to five years old.

CW: You know, motors just don't suddenly fail because the voltage is low. What happens is they draw more than rated current. And, typically, as the temperature goes up, that rule of thumb is for every doubling of the…of every 10-degree increase in temperature, the life of the insulation goes down by one-half. So, what could have been happening is that these motors were overloaded five years ago, but it took until now for the insulation system to finally get to the point where it failed. So, this could have been going on right from day one.

JL: How long have you had the motel, has it been the management…

LW: I have had it for seven years.

JL: You've had it for seven years?

LW: And we've had it for seven years, but…let's go back. You made a comment there. I want you to explain that. We might have had more voltage coming out at that time.

CW: You know, as I think about that, it's more likely that we had the same situation then, but your motors were drawing more than rated current, and the insulation was aging faster than it should because of that. Because you had the wrong piece of equipment on a 208 volt system.

LW: The other air conditioners I had lasted 15 years.

KW: What were…We don't know…what were those motors rated at?

LW: 208-230.

CW: And there's a big difference in motor manufactures, like with…

LW: I have got two here. I've got Amana and Comfort Air.

CW: Like I said, some motors have more iron and more copper and better insulation. I mean, there's all classes of insulation B, C, F, I mean. So…

LW: Well...

CW: It's a complex situation to figure out why one might last you know 15 years and another fail.

LW: That might be. But, I mean, that doesn't...

KW: But you see our dilemma. If we raise the voltage, then some of your customers plugging in a shaver or something in a 120-volt socket, would have way too high a voltage, possibly. And so we don't want that to happen either.

LW: What is my average here? You tell me. What is my average on a 120?

CW: Well, it is hard to average that out, but I suppose you could be aligned somewhere in here, and it looks like it'd be a little bit lower than 120. This one looks like it might be right around 120. And then understand that for us to raise the voltage, we raise the voltage in all three phases. We don't have the ability to just raise the voltage on phase A or just B or just phase C. That tap is a three-phase tap.

LW: I understand. Understand, but going back, why is my 120 going back and forth? That's, you turn on a light. I mean, it's not going to...it's not like turning on a compressor motor.

CW: Well, it's also the feeder voltage as well. You know, you have all number of customers on that feeder, and as customers turn on things and turns things off, that voltage is fluctuating up and down. That's why we got a range of voltage and not just a single voltage.

KW: Here's the problem. And we'll...*you're asking very good questions.* And I think we will be able to...let me finish my math here. Okay. The taps in transformers, there's three levels. One is the nominal rated tap setting. For example, a 120-208, at the 120 volt level, 120 is the mid-point. You can lower it 95%, or raise it to 105%. Okay? In this case, what we're taking about is raising it to 105% of its rated, steady, middle point. So, at 120 volts, if we raise it to a 105%, you're now to 126 volts. That becomes your new middle state. Plus or minus 5% of that, is where the problem comes in. Because we are going to fluctuate as we've shown. This isn't gonna change. The fluctuation isn't gonna change if we raise the tap. So, there's gonna be times you're gonna run up on the high end of 126 volts, takes you up to 132. Okay, that is where the *problem comes in. I mean, it's all of your* equipment that runs on normally 120 volts, that'd be your lights, your normal wall receptacles, your computers, TVs, whatever else you've got, is going to have to be able to operate at 132 without burning up. That's what we worry about when we raise taps. Now, on the...okay, you see where I'm going with that? So, when we...it sounds simple to raise the...now, I found a 120 sign on the 208 side. Do the math on that.

But that's where I'm worried for the other pieces of equipment inside of your building. If we raise taps, we don't have the ability to raise taps only on the 208 portion of the load. It's all or nothing. It's gonna impact both the 120 and the 208 side. So, we might be raising taps to help your air conditioning and ice machines, but it's the impact now to the other things that are gonna be in there that are gonna be receiving the higher voltage than what they're really meant to operate under. Does that make sense? We can do it, but we don't like to because we know is what's gonna happen is your other things are gonna burn out and we're not...that's what I was talking to you about before is we don't want to be responsible. We can't be responsible for the other things that go bad in you facility because of raising the voltage to solve just one little problem that you're having. So that's why we typically do not raise taps in transformers.

What we then suggest to do is either change voltage altogether, or we suggest that buck booster type of a solution, that you can put on a very specific piece of equipment. Does that make sense?

CW: Yeah, we can raise the taps, but if we do that, we're gonna ask you to indemnify APS from all the other equipment that's eventually gonna have problems, because we know what is going happen. That's the problem.

KW: What we've got here, Mr. Wheeler, is you've got a piece of equipment that was not designed to operate normally at 208 volts, within a 5% band. It operates at 208, but we can't, as an Utility, ever guarantee it's gonna always stay at 208. So, now we have to look at the solution. There's pros and cons of all the of the solutions and what you'll have to do is pick the one that's gonna be...you're looking at the least cost standpoint and we appreciate that. We want to do that too. But it's also, you gotta look at what it's gonna do to everything else in there. And when you pick a solution that we know is going to cause problems to other pieces of equipment, we're gonna recommend that you not do it that way. Because you'll be calling back up again, saying, "Hey, I've burned out...I'm burning out computers, TVs, light bulbs, refrigerators," whatever it is. We know it is gonna happen. That's why we don't do the taps. So, we go and talk about what the other solutions are. And that's where we're at.

CW: There's a number of articles out on the web, this just happens to be one I pulled off. It talks exactly about this problem. You put a 208, 230 volt motor on a utility system; you can expect that to have serious problems. So, this is not an unusual situation. It occurs all over the United States. The basic problem is you've got a device that's not designed to operate well on a utility 208 volt system. So, one solution is to get the right voltage to this device with a buck boost transformer. Another solution is to change out the voltage, but now, if you change the voltage to 240, it could be that the motor, if the three-phase motor on your washer is a 200 volt motor, it's not gonna be able to operated on a 240 volt system.

KW: Right.

CW: You're gonna have to go look at all the devices that you have connected to see that you will have the right voltage for them.

KW: That's what we were talking, previously, is, I think there's really two solutions and you'll have to decide, based on what you want to do, and that is, and part of it is getting, you know, some hard estimates from folks. But to move to the 240 volt system, or to do the buck-booster system. And frankly, APS is indifferent. We're prepared to change out the transformers, and we…at no cost to you. We've already investigated your switch gear, and we've got the letter from your switch gear manufacturer that says all you have to do is re-label, so that's a good thing. You do have to still investigate and I think you said, you know, whatever you need to do to get your single phase equipment off the wild leg, that's gonna be created when we change into a 240, you'll have to do that. And then you'll have to take care of your washing machines that do need to be at 208 voltage, which now on a 240 volt system won't work. That's option one. The option two is the buck booster option. And I'm not familiar. I know conceptually what it does.

LW: Yeah.

KW: I don't know what the implications are to the rest of your system, but in either case, an electrician's gonna have to guide on that. There is no…unfortunately, there's nothing, there's no device, there's no quick fix that APS can just stick up there on the system to magically make this go away. We can fix a part of it, but it creates another problem, and that's what our concern is.

LW: Even if…there's a possibility, as this gentleman said, that five or six years ago, that I actually had more voltage coming in from APS?

KW: It could have been, but I don't have any way…I do not know.

CW: It still would have been within range A. So, probably it was within an acceptable range, but what I said was, that even five or six years ago, if you had this motor on our system, it would have been drawing more current than rated current and you would have been taking serious life out of the insulation system. So, the motor doesn't just suddenly fail one day because the voltage is now, you know, at 180 volts or something like that. It's overheating and it takes a number of years before it finally fails.

LW: See, there again, that's not what I've been told. They have told me that as far as the overage…does, by far, less damage…

CW: Well, that's…

LW: Than on the low side.

CW: Well, in your range, you're right. If the average is between the 208 and the 230 range, you are absolutely right. That's the way they're rated. And we would agree that it's meant to operate in that range.

But if you put 228 volts, you know, Ken, if we somehow raised the voltage 5% and you put 228 volts on your 200 volt washing machine motor, it would burn out in a hurry. You would draw a lot of current. As long as this was the range, if the voltage is on the high side, and the motor draws a little less current because power is voltage times current. The higher the voltage, less current for mechanical load. But now, you reach another point where, when the voltage goes too high and the flux in the core saturates, now in order to try to get the flux where it wants to be, it draws way too much current. So, you can burn out a motor on high current at high voltage, just as easily as you can burn out a motor on low voltage and high current. So, you've got to try to keep that motor within, you know, the proper voltage range that it needs.

LW: You're saying if you raise it 5%. What happens if you raise it two and a half percent?

KW: It's not po…they're not capable of doing that.

LW: They're not capable of what? I'm not…

CW: Well, we can raise voltages. We have…

KW: On the primary side.

CW: Yes

KW: Perhaps. If…depends on what the substation transformers are. If it's not at the secondary voltage.

CW: Typically…typically, we have high taps, no low taps.

KW: Yeah.

CW: In…in…but even then, raising it two and a half percent, we'd will still have the same issue…

KW: That's right.

CW: That we would have too high a voltage. We'd be way out of range A, and we could be putting your 120 volt loads, receptacles, in danger. And some of the commercial customers I've dealt with, like Allied Signal here in town, I'd raise the same thing. I said, "If you want to sign a legal document saying that you will hold us harmless because we increased the voltage and they've never…" and once their engineers looked at that and lawyers considered it, they never went forward with it.

LW: Hmm.

CW: And you wouldn't want do that either. You're taking too big a risk. In fact, I'm not even sure we should do it. And even I…

KW: Well, that's why we don't…we don't prefer to do that.

CW: You're taking too big a risk that you're gonna damage equipment on the other side, having too high a voltage. Because the voltage…you're not gonna get rid of this fluctuating. If you raise the voltage, you're simply gonna raise the whole level.

KW: The bar…

CW: You're still gonna…the scales change, because it fluctuates.

KW: Right.

CW: The magnitude of fluctuations are still going to occur. It has to do with all the customers on that feeder. And so when it's on the high side, you could really be on the high side, to the point where you're damaging other equipment.

KW: That's our worry.

LW: Would you say that the…using this table here, that the 120 is high either way, in others words, 114 to 126, would follow along with the 208…

KW: Yes.

LW: …being at 197…

KW: Yes.

LW: …up to 218?

KW: Yes sir.

CW: The way…the way…

LW: So in fact, I've got low voltage, really, on the 120 side too?

KW: Yes sir.

LW: To a certain extent?

KW: It's the same…

CW: Within the five…within the five percent range, yes. So, it's not falling to…into 120, 95%, 114, something like that, I'm trying to do this off the top of my head.

LW: So it's at 114 and five percent over is 126, according…

CW: Correct.

LW: …to this table?

CW: Right. So, yeah, and I think…and I think…let me see this. What's the scale on this graph? This is the 120 volt scale. This is not the 208 volt scale.

LW: Right.

KW: And so, you can see…yeah, you can see how this is falling, at the 120 volt level. This…120, here's 120, here's 120, here's 120. So, you can see that here's 114 going down here. We're not close to it.

LW: Right.

CW: And you can see we are actually a little on an average here, but we are below it on here.

KW: That little diagram I just showed up, that is what your transformer looks like. You can see the 120 and the 208 is the same transformer. So if you raise the… change the voltage on 208, you're changing it on 120. The taps are in those windings. So, there's no way to change the magnitude of those voltages separately from each other.

ANGELA ALLISON (AA): Yeah. He'd also store, offset (inaudible).

KW: I see. Be right back.

LW: Well, I don't know…I do not know what else to say. The only thing that I can tell you is up until three years ago, I was having no problems. At the present time, I have 28 units that went out. Now, that tells me, at first, hey, you're getting some bad compressors, some bad motors. I went back and I checked, they said hey, "Hey, that model, which is a Tecumseh, we've had no problems with whatsoever." So we started watching and checking and just found…

CW: Probably could…

LW: …the voltage every time we checked was down below.

CW: And probably if those motors were on a 240-volt system, would not have problems. So, those customers having a 240-volt system using that motor probably did not have any problems.

LW: Well, there again, I'm not…I'm not disagreeing with you. All I'm doing is making a statement that before this time, the same man has worked on this hotel for the last 15 years.

CW: Mmm-hmm.

LW: And he said...we've never had any problems with (inaudible).

CW: Well, one of the reasons I asked you if you rewound the motors, and you said you didn't, and that's a good thing, because I see a lot of... I've done a lot of court things and depositions and what not on this, on motor failures, and people will rewind a motor, and what happens, is if you don't rewind it properly, and as you burn out the windings, you damage the laminations of the metal, and you create a hot spot. It's not something you can see with a infrared camera, because it's disbursed through the whole machine, and what happens is it takes three years for that motor to fail, after it's been rewound, put back in service, and by that time, the rewind shop says, "You've had the motor for three years. It can't be our fault that we rewound it improperly."

LW: There again, I understand what you are saying, but this...

CW: In other words, motors don't just fail because you've had low voltage; the motor just doesn't fail in a couple of days. What's happening is that motor is running at much higher temperature than it's designed to operate at. And that takes years for the insulation to finally fail.

LW: There again, from what I have been told, it depends on how long it runs, how many...how long it's heated up like this (inaudible) fan. I am not disagreeing...

CW: If we...

LW: ...when you say years, I'm saying, okay...

CW: You know, if the utility voltage was right up at 208 volts, for five years, and never went below 208 volts, probably those motors would have lasted a lot longer. But of course, the reality is we're dropping down to 197 frequently, and maybe even a little bit below that, on a steady state basis. I'm not talking about motors starting, causing the voltage to do up and down, I'm saying on a steady state basis. So, if somehow a feeder could stay right at 208 and never get below that, probably the motor would last 18 years, you know, 12 years, and it wouldn't seem like they're failing so quickly. But that's not what utility voltage is, even here in town. Anywhere in the country, a 208-volt system is gonna drop, is gonna be within that range A and occasionally, it's going to drop outside the range A. It's gonna be a little bit worse in some cases.

LW: Well, there again, there seems to be a conflict. This... Mr. Geiger indicated, he says, in Phoenix, APS's standard 208 service comes in 210, (inaudible). No problems.

CW: Well, I work for APS and I can tell you that's not the case.

LW: I mean, that is........

CW: You can see it right here. In the standard that applies to utilities all over the country, it's saying that 208 volt, as long as it's within that range, that 208 volt, as long as it's within that range, as low as 197.6, that is normal utility voltage for a 208-volt system.

KW: And I don't want to disagree with Mr. Geiger. I'm sure he's telling you, based on his experience. He's taking snap readings and what a snapping reading means is at any given point in time, when he puts his volt reader meter on there, that's what it is at that moment in time. But that doesn't give you the benefit of a 24-hour period or over a duration in time. So I am sure he's right. At a point in time when he was out there, it was reading at 208 or 210 or whatever it happened to be. But, over the course of a duration of time, it's not gonna change remain that.

CW: Now, *that CBEMA curve, it doesn't apply to motors.* It's a Computer Business Equipment Manufactures Association. You know, that's saying that on a steady state basis, many seconds and minutes, plus or minus 10%, would be okay. And then they're further saying, you know, if you are talking about a microsecond voltage drop or transient, that should be okay, but if they last for too long, you're outside of that CBEMA curve; then you can expect to have problems.

KW: I mean, we'll be glad to actually talk with Mr. Geiger. I mean, we're not gonna convince him of anything else. But just try him...just try to talk to him and get a little bit more understanding to what he is seeing and recommendations at your site. Make sure we're all on the same page, just like we have done today. I wish I could just send somebody out there now and make it magically go away. But if I do, it's the other equipment that I worry for in your site that will be impacted. There's no reason for APS to intentionally deny you a voltage in your building. We have no reason. There is no benefit. There is no upside, downside.

CW: We want you to use our product.

KW: We want you to use the product. We want it to be...to get it to work right inside your building. The problem is there's unintended consequences to making any changes and we want to make sure those are all covered and you're fully aware of them prior to just, you know, doing it. We'll do it. Whatever you want us to do, but we may ask you to acknowledge some other problems that are going to happen, and we know they're *gonna happen*. So, what we'd like, in our recommendation is for you to work with these guys or an electrician of your choice and look at what will be a long-term solution to it and protect all your equipment, not just solve the one problem with the AC units. Because we can do that, but we know, your lights are going to go.

LW: Well, there again, guys, we can cut this thing short, and I will.... You can call Mr. Geiger. I will call him; I will also call an engineer.

KW: Okay.

LW: But I do repeat, the last 15 years we have had no problems with air conditioners.

KW: Well, I think it is really just since these particular units have been installed.

LW: Well, the...

KW: I mean, I...and you've got us to a disadvantage here, because I...other than the last couple of years that I worked in the Buckeye office, I don't know what was actually there and I do not think you're gonna find anybody that will have...

CW: But we would have operated within range...

KW: We would still have been within the 5% range; I mean that's just the way it goes.

LW: I understand what you're saying. But you've got realize the information that I am being fed on it...

KW: Right.

LW: ...and I assume, because they have nothing to gain or loose on it...

KW: Right.

LW: ...the supply house where I buy my equipment, the Amana Corporation, when I tell them the model, he said, "You know, if we had had a problem with that model," he said, "I'd tell ya."

KW: Right, and...and...

LW: "...because chances are, we would have found a way, or we have found out what the problem was, got it fixed, you either change the unit out , cut your deal on it or whatever.

KW: Right, and to be honest with you, supply houses have...they don't necessarily understand the entire operation of your facility. They want to sell you a product. And if you tell them that you have a 208 volt system, they're gonna give you a 208 volt motor, but that person may not be of the understanding of that 5% swing. It should not have been...you know, looking back, it's easy to say, but to be honest with you, that's a mismatch for the kind of service you have got. We would not...had we talked to you before you bought it, we would have never told you to buy that motor. We would have told you to buy *either a 208, you know, something* that's for the 208 volt itself, which, in case, would have been a 200 volt motor; that's what we would have done. And this is easy in hindsight. No, don't get me wrong. I don't…

LW: Well, there again, there is no choice in this. In compressors, you've got one…

KW: Well, no, there was when the original unit was purchased, that is what I was saying. The whole…

LW: Even the original units. They don't break it down like that.

CW: You can order it, with all due respect. Yes, you can…

LW: No, you can't…

CW: Okay.

LW: That's wrong. I understand what you're saying, yes. You take a large air conditioner…

KW: No…

LW: APS…

KW: Window unit.

LW: But window units, no. yes.

CW: I've seen compressors many 200 volt…so you can use compressors.

LW: We…

CW: What you might be dealing with is a supply house that may not have access to something like that. Maybe they weren't aware of the total system, the total…what you're…the service that you were receiving from APS. But…and they didn't have a product that matched that and they were trying to sell you something. I don't know…we're in hindsight here, so it's very…it's all speculative. Nobody knows.

LW: Well, there again, you don't know.

KW: I don't know.

LW: Let me (inaudible)…but I do know this. I have another person in the same business, who is running the same Amana units as I am. He's had them in there for 12 years and lost one fan motor.

KW: And has he got a 208, 120 volt system?

LW: 208, 120 and he's running at 215 on all three.

CW: 215 volts?

LW: Yep.

CW: Let me warn you against something that somebody may suggest, but is not a good idea. I had a customer that was bringing out motors, so he said, "I know what I'll do. I'll just oversize the motor because an oversized motor, you know, draws less than rated current, but apparently, on the some of these fan coil type units, the air over the motor is a very critical part of cooling it. And by having too large a motor, he wasn't getting sufficient air over the motor. So even though he was drawing much less than rated current, he was burning that motor out. And that was just a hard lesson to learn. And we ended up working our way through GE to finally get to some appliance engineer who said, "Yeah, you know, you don't always just want to put in a larger motor and think that'll solve the problem." So, putting in a larger 208, 230 volt horsepower motor, might not necessarily solve the problem.

LW: No. No, I agree with you exactly on that. But as I said, 15 years ago, no problem. Amana says no problem. My friend who has been in the business, no problem, 215 volts on all three.

CW: I have heard lots of myths, and particularly among electricians. One of the myths is that when you're starting a motor, you're setting demand, and that's absolutely not true. Because our meters are 900-second, 15-minute integrated demand meters. The one second it takes to accelerate the motor does not set demand. But, I've had so many electricians say, "You gotta be careful. When there's an outage and you go to start motors, you can expect a high bill that month, because you've just set a very high…" So, I know a lot of electricians who have misconceptions about some basic stuff. I'm not saying engineers always know what they're talking about either. But there are a lot of misconceptions out there in supply houses and electrician about what causes equipment to fail.

LW: Well, I'm sure that it is true. I'm sure that is sure.

CW: But, I can tell you, I know Mr. Burgett, and I think he is a fine engineer. I don't know what he'll say, but I know him to be a good engineer.

KW: Well, here's where we're at with this. If you want to get a recommendation from your electrician, we'll be glad to work with him. But, whatever you tell us to do, we'll do it to solve your problems. Just, when we… when you make that decision, we will just ask you to, depending on what the decision is, to indemnify APS from what the bad side of the decision is going to be, to solve the problem, unless it's to change it to

120, 240, where we would ask you then to make sure your electrician looks at all the other wild leg issues associated with that.

CW: Do you know what a wild leg issue is?

LW: Mmm-hmm.

KW: Or if you go with the buck booster, there would be nothing, and that's something you would do. But we're gonna do whatever you want us to do. We're just trying to make you aware of what the consequences are.

LW: I...

KW: And we know there's a consequence with every one of the options, and that's where we're at. APS does not have a magic device to put up there to solve it.

LW: Okay, now you are telling me, in fact, that you have the ability to actually turn up the power?

KW: Yes turn up the volt...

CW: Voltage.

KW: The voltage.

LW: The voltage. So, when you turn up this voltage, is there a set of amount? I mean, would you click and it goes up 5 volts?

CW: There are taps in this transformer. And it's, as Ken said, typically, you have a mid point, and you can go up in two and a half percent increments, two and a half percent. So it's a five-tap position; you've got the mid-point, two and a half percent, two and a half percent...

KW: It depends on the manufacturer of the particular equipment.

CW: Yeah, it depends on what our transformer is, but I would highly recommend against that, because here's what the fluctuating is doing, and, so at 2 o'clock in the morning, you have a customer that plugs in his hair dryer, her hair dryer...

KW: Turn on the TV, or whatever...

CW: And it burns out the hair dryer, because you've got way too high a voltage on the 120.

KW: Well, the other reason why, Chris, in addition to what he is gonna see, is that at any given time during the year, we may be addressing...there may be adjustments to transformer taps on the transmission voltage, at the generator…

CW: Yes.

KW: At the 230 sub…

CW: Right.

KW: …at the 69. And you don't, you can't go back to every single…

CW: Right.

KW: …customer transformer and make adjustments. And that's why you do not do it.

CW: Power to a hairdryer or to a light bulb, the electric power is V squared over R. So, if we raise the voltage and you are squaring the voltage, you can have a *dramatic increase in the input* power of that hair dryer to the point you burn it out or a light ball. So, it's a very significant relationship. I mean, ideally, what you want to do is have the same kind of voltage fluctuation we're trying to maintain, plus or minus 5% on your system in your motel. You don't want to be outside on the high side and risk damaging your equipment and the customer's that stay in your motel.

KW: That's the problem

LW: Would raising this voltage two and a half percent, where will that put me at now, with where I'm at?

CW: Well, take…

KW: Do the math and I am going to make a quick phone call. I don't even know if that transformer can go up two and a half percent.

CW: Yeah, it may not. If it's an overhead transformer.

KW: It's overhead.

CW: It may be limited to just five percent.

KW: Let me call him.

CW: Let's see, what am I looking at here? So, here you are. Now, that was the average. I have no idea what the…what the peak is.

KW: Mmm-hmm.

CW: So it would raise the average by two and a half percent, but what would that do to the peak? You know, the peak may even shoot up…

KW: The peak would change it out of that range, correct?

CW: It could. And…and also we're just looking at a snapshot of a few days. We're not looking at 365 days. I mean, there'd be other times that we could, you know, have other…

LW: The voltage is standard here. I mean it is not fluctuating, right?

CW: OH, it…I mean, what I'm looking at is…see all these little tiny things right here? Those are window units coming on and off and other loads on the feeder. Now, this is sort of a sort of steady voltage, you know, that's going along here.

LW: Is this, when you say voltage, is this voltage or the amperage?

CW: Voltage. Voltage.

LW: What is this up here?

CW: You know, this…this might be 120 right here, we're looking at and this is the 208 that we're looking at up here. The 208 RMS and, for some reason, we're not seeing…you know, I honestly don't know what I'm looking at because I don't know what equipment you're using, what you're doing here. I'm just sort of speculating.

LW: All I'm saying is that because it's got...

CW: Maybe this is sort of the average right here. It could be that you're trying to plot the average voltage.

LW: Well, I'm just saying that because you've got the 200 here, and the line follows pretty much through it, and they're showing 210 here, which makes sense, But you go to this one, and it's lower.

CW: You know, it may be taking the average over an hour or something like that, and so we're looking at sort of an average, but we do not know from this what the peaks might be.

LW: Right. But you've got…1, 2, 3, 4…you give five or six days there. On an average. Now, as I understand…

CW: Now, we tend to be higher in the winter time and lower in the summer. I mean, because the load is less in the winter time, our transmission voltage, everything, tends to be a little bit higher and in the summer it tends to be a little bit lower. So we have this summer-winter difference, as well as this daytime, nighttime difference that occurs all the time.

LW: Well I guess what I'm saying is if you raise two and a half percent, I do not see, as far as the spiking that you are talking about, being…

CW: If we…

LW: …a problem.

CW: If we raised two and a half percent, there is a danger that you could damage other equipment, and also, you will not affect what's happening to these motors failing, because you'll still be on the low side at various times, lower than 208, in range 5.

LW: As I said before, that is not the problem as I've been told. It's when it is continually below that.

CW: And we can be continually at 197.6.

LW: I know that you can, or so you're saying, on this. What I'm telling you guys is my appliances won't…number one, air conditioners will not operate on 197.

CW: Have you got a web site? I'll send you some compressors that operate at 200 volts.

LW: They've got to fit…

KW: Right.

LW: …my air conditioner.

CW: And you can buy window units, of course, that operate on 200…that are rated 200 volts or...

LW: Well, yes I can, but, if I had been having problems with this for the last 15 years, I would have done something. I would have…when I bought these new air conditioners, I would have said, "Hey, lets do this," or if when I built the hotel, if I had built the hotel, , I would have said, "Now, what is our best strategy here as far as what do we want to put in."

CW: Mmm-hmm. That's hindsight, and we can't…we're not there. Right.

LW: I did not build it, somebody else did. I inherited, and this is the only thing that I know.

CW: Okay, now one thing to look at is, just to…what I'm suggesting is, you've got a service entrance, main panel board, and you've got your main…your feeder breakers on that panel board, and if it turns out that you have a feeder breaker that feeds 20 window units and then another feeder breaker that feeds another 20 window units, it may not be that expensive or complicated a deal to add a buck boost transformer on that particular feeder, that will raise the voltage for 20 window units, and then another one that'll raise the voltage for another 20 units. It's not like you've got do your whole system, just the window units and ice machine, where you've got the 208 slant 230 volt motor. So you may be looking at that may be 3, 4, 2, transformers that need to be installed that will raise the voltage to the appropriate level for those particularly 208 slant 230 volt motors. And it seems to me, going to a…you know, yes, that panel board may be… they're rated 240, 208, so it's not a big deal to change that panel board to, you know, to operate at 240. You don't have to change the panel board.

KW: He doesn't have to, no.

CW: But…

KW: Okay here's some other information. I did talk to Greg Cox, you might know Greg. That particular transformer, those particular transformers, three-pod bank, they do have two and a half percent increment tap.

LW: Okay.

KW: Okay. The problem… I don't know, what you guys are talking about, in the room. The problem is, of course, that over the course of a year, if we raise it at two and a half percent, it might be good today, but once…

CW: In the wintertime…

KW: In the wintertime, the voltage is even gonna go higher and you're gonna have other problems, okay, with the non-208 part of your facility.

CW: Your other 120 volt receptacles.

KW: It's gonna go…as we were talking about. So we're back to some of these other problems. Let me just kind of talk outside. There's something else that APS is doing in the area with the Gila Bend System, that I think it's advisable we look at and see what the impact is gonna be. Within…I don't want to put…hold me to a time frame on it, because we're dealing with the state highway department with a permit, which, that's out of our control. We're gonna put…APS is putting what we call regulator on the system. And what a regulator does is if you…if you use this graph, one of these…it monitors…

Fw: Motors 240 v on 208v Sunday, January 11, 2009 8:15:12 PM

From: lwheeler@cox.net

To: wheels135@comcast.net

----- Original Message -----

From: Christopher.Weathers@aps.com

To: lwheeler@cox.net

Cc: Angela.Allison@aps.com

Sent: Tuesday, January 06, 2009 10:31 AM

Subject: FW: Motors 240 v on 208v

Mr. Wheeler,

Attached are a number of internet sites pertaining to the problem of 208/240 V motors. I haven't looked through these internet sites to see if there are compressors with 200V motors. One of my mechanical engineer friends, says that there are very few AC compressor manufacturers supplying AC compressors to the industry. [redacted]

Be that as it may. I have worked with quite a few customers who have had problems with 208V/240V motors. This dual rated motor is not a NEMA standard motor. Per the internet sites below, and other internet sites, there are concerns, when the voltage of a 208V system is on the low side, but still within utility ANSI 84.1 standards. The most common solution has been to use a buck boost transformer to increase the voltage to the dual rated motor.

In Arizona there is another factor than may explain your failed motors. As temperature increases, the mechanical load on the shaft of a compressor motor increases. This is because the compressor has a higher head pressure at elevated temperatures. If the AC units were marginally sized for the square footage of cooling required, and the utility voltage was on the low side, but still within standards, and outside temperatures is high, these dual rated motors will draw more current than what they are rated to handle. The higher temperature also impedes cooling of compressor motors.

If in addition, these motors start cycling on and off, due to high motor temperature, the frequent starting will also significantly affect the life of the motor. Mechanical and thermal stress on the motor windings vary with the square of the current.

My recommendations are to observe operation of the air conditioners to see if they are cycling on and off during hot, summer temperatures. Also make sure the air conditioners are checked at the start of each summer season to make sure they have the correct refrigerant charge, since that also affects temperature of the motors.

Call me at 602-371-6563, if you would like to discuss this issue further.

Regards,

Chris Weathers

From: Teslevich, Gregory (H94274)
Sent: Tuesday, January 06, 2009 10:55 AM
To: Weathers, Christopher (L97161)
Subject: Motors 240 v on 208v

http://www.brithinee.com/resources/240vs208volts.htm

http://www1.eere.energy.gov/industry/bestpractices/pdfs/mc-0381.pdf see section 14

http://www.baldor.co.jp/image/pdf/POWERSYSTEM.pdf

http://findarticles.com/p/articles/mi_qa3726/is_/ai_n19511123

ATCH #19

GEIGER ELECTRIC
INC.

Invoice

Invoice #	9415
Date	9/4/2007
P.O. No.	
Terms	Net 10
Work Order #	07-0038

Bill To
America's Choice Inn & Suites P.O. Box 51954 Phoenix, AZ 85076

Description	Amount
08/30/07	
1.00 HR - Travel	
1.50 HR - Meet with APS, Turn Off Power to SES, Have APS change primary taps to 95% (MAX) setting which raises output voltage approximately 6 Volts phase to ground and approximately 10 Volts phase to phase.	
1.00 HR - TRAVEL	
Total Labor	315.00
Sales Tax State	0.00

Make all checks payable to GEIGER ELECTRIC
If you have any questions concerning this invoice, please call 623-773-1787

Total $315.00

ATCH #20

From: Angela.Allison@aps.com [mailto:Angela.Allison@aps.com]
Sent: Friday, June 19, 2009 3:11 PM
To: Connie Walczak
Subject: RE: Lynn Wheeler - America's Choice Inn and Suites - Gila Bend, AZ. (Old Inquiry 61782)

Connie,

In response to the request from Mr. Wheeler and after an extensive search of APS records over a 14 year period, I have assembled responsive information. Attached is a spreadsheet which lists the number of new meter sets to the feeder (Gila Bend 22) serving the America's Choice Inn & Suites in Gila Bend. The feeder currently serves 439 customers who are located between the boundaries of Sisson Road to I-8 and Citrus Valley Road to Stout Road.

Additionally, I have listed the improvements made to the feeder since 1995. It is important to note that the improvements listed below occurred after Mr. Wheeler first notified APS of his voltage concerns in June 2006. Prior to Mr. Wheeler's complaint(s), APS records do not indicate any additional improvements other than normal repairs after storms.

- On March 6, 2007, APS removed a redundant capacitor bank because it was affecting the harmony of the other capacitor banks.
- On July 13, 2007, APS converted a tangent pole (pole designed to support conductors in a straight line section) to a double dead end pole.
- On March 7, 2008, APS installed a voltage regulator bank to maintain consistent voltage.

APS also increased the voltage from the standard 120/240 volts to 120/208 volts on the three transformers serving America's Choice Inn & Suites as a result of the mediation held at the Arizona Corporation Commission on August 22, 2007. See attached release signed by Mr. Lynn Wheeler holding APS harmless of any future damage the hotel may experience as a result of the increased voltage.

Please let me know if you have any questions.

Thanks,

Angela Allison
APS Sr. Consumer Advocate
602-250-2280

ATCH #21

TOTAL NUMBER OF NEW METERS INSTALLED PER YEAR AND PER CLASS OF SERVICE
FEEDER: GILA BEND 22

YEAR	CLASS OF SERVICE	# OF NEW METERS SET	CLASS OF SERVICE	# OF NEW METERS SET	TOTAL
2008	Residential	2	General Service	3	5
2007	Residential	1	General Service	3	4
2006	Residential	2	General Service	0	2
2005	Residential	6	General Service	2	8
2004	Residential	3	General Service	1	4
2003	Residential	3	General Service	7	10
2002	Residential	6	General Service	5	11
2001	Residential	5	General Service	2	7
2000	Residential	5	General Service	8	13
1999	Residential	2	General Service	1	3
1998	Residential	8	General Service	4	12
1997	Residential	2	General Service	0	2
1996	Residential	2	General Service	1	3
1995	Residential	2	General Service	0	2

John LaPorta

From: Prem Bahl
Sent: Tuesday, June 19, 2007 5:16 PM
To: 'Jennie.Vega@aps.com'
Cc: John LaPorta; Del Smith; Angela Allison
Subject: *Customer Complaint*

Jennie,

This follows up my conversation today with Angela Wilson and Ray Passarelli in regards to a complaint of low voltage by Lynn Wheeler of Gila Bend. Ray explained the steps APS had taken to improve voltage at this customer's premises, which is a hotel. Supply voltage is 120/208 V. Ray stated that APS changed the transformer and its settings to improve the voltage in the fall of 2006 to 207 V phase-to-phase. The 73 air conditioners installed at the hotel are designed to operate at 208/230 V. Even if the voltage is within permissible limits of +/- 5% variation, it is understood that these air conditioners do not operate efficiently at voltages less than 208 V. The customer desires to have electric supply at a higher than 208 voltage. I suggested to Angela that APS may offer to the customer higher voltage supply option, providing him with a cost estimate, for which he would be responsible, and meantime maintain the voltage at the premises at 208 V or slightly higher.

I know APS has the tools and the ability to deal with this customer and his problem.

Thanks for your attention to this urgent matter.

Prem

ATCH #22

ARIZONA CORPORATION COMMISSION

UTILITY COMPLAINT FORM

Investigator: John La Porta **Phone:** (602) 542-0819 **Fax:** (602) 542-2129

Priority: Respond Within Five Days

Complaint No. 2006 52810 **Date:** 6/9/2006

Complaint Description: 05G Quality of Service - Pressure/Voltage
N/A Not Applicable

	First:	Last:	
Complaint By:	**Lynn**	**Wheeler**	
Account Name:	JALLL, LLC - America's Choice Inn & Suites		**Home:** (602) 881-7291
Street:	2888 Butterfield Trail		**Work:** (000) 000-0000
City:	Gila Bend		**CBR:** 928-683-2120
State:	AZ	**Zip:** 85337	**is:** Fax

Utility Company. **Arizona Public Service Company**
Division: Electric
Contact Name: Angela Allison **Contact Phone:** (602) 250-3766

Nature of Complaint:

Mr. Wheeler waked into the Commission's offices in Phoenix on June 9, 2006. He states that he has asked Arizona Public Service Company if they would put a special meter on his property that prints out the voltage. He requested this two weeks ago from a lady named Phyllis (623-932-6677), who told him that she would get back with him.

Customer has called and called - leaving messages for Phyllis, but she has not returned the calls. Customer states he has had his voltage tested and it varies from 207 to 194. Commission asks APS why they can not supply him with this special meter. Why are the customer's calls not returned? Please advise both customer and the Commission on your findings.
End of Complaint

Utilities' Response:

06/14/06-Good morning John,

[redacted]

I contacted Mr. Wheeler yesterday and asked if he had experienced any problems since we were out on May 22nd. He said APS was out again on Monday 6/12/06 to test the voltage and it was out of range. He advised that he would like the recording volt meter installed. I told him I would submit his request and follow up with him.

Mr. Wheeler called me back this morning to let me know that APS did install the recording volt meter he requested. He mentioned he would like to have his transformer upgraded as well. I contacted the local office who will run the necessary calculations and get back to him regarding the upgrade.

Please let me know if you have any other questions.

ATCH #23

ARIZONA CORPORATION COMMISSION

UTILITY COMPLAINT FORM

Thanks, Jessica

06/30/06-Hi John,

I spoke with Mr. Wheeler on 06/22/06 and he questioned why two separate APS serviceman were on his property installing two different recording volt meters (RVM's). I explained that, apparently, it was found that the previous RVM on the transformer was installed incorrectly. So, APS was out today to install another RVM on the transformer serving the hotel and another RVM on the customer's equipment (meter panel). I also advised Mr. Wheeler the two new RVM's are more sophisticated and high-tech and will be removed on Tuesday, 06/27/06. I apologized for the confusion and offered to be his point of contact at APS.

I spoke with Mr. Wheeler again on 06/29/06 and explained the RVM's were removed this week and the results showed that APS is within our limits for the voltage levels. The problem is on the customer's side. I explained that the local APS serviceman would like to sit down with him and review the results. Mr. Wheeler said he does not want to meet with anybody and wants to pick up the results at the local APS office. I advised I would have the results faxed to him in the morning.

An APS engineer faxed the results to Mr. Wheeler this morning. This should resolve his concerns that there is a problem on APS's end. Please let me know if you have any questions.

I will fax you a copy of the results that were faxed to Mr. Wheeler.

Thanks, Angela
End of Response

Investigator's Comments and Disposition:

06/14/06-I spoke with Mr. Wheeler who advises that APS is working with him will get back him after 06/19/06 about increasing his power.

06/14/06-I spoke to Jessica Hobbick at APS who will be gone the week of 06/19 thru 06/23, but is planning on calling Mr. Wheeler and me on 06/26/06 to provide an updated response.

06/22/06-After receiving two voice-mail messages yesterday from Mr. Wheeler and becase I was not in the office yesterday, I called him this morning. Mr. Wheeler was troubled because of the delay in getting results of the voltage test. Angela Allison from APS reported that they are trying to get the results from the volt test as soon as possible. Mr. Wheeler wanted these results placed on disc, so his own engineer could have them. However, APS can not do that for the customer. APS will contact Mr. Wheeler as soon as the results are in.

06/29/06-Angela Allison from APS called to say test results reveal the voltage is reading properly. Ms. Allison is going to have an APS engineer contact Mr. Wheeler and they both can go over the resutls. Ms. Allison will follow-up with another e-mail; when this is done. APS sent the over the results of the voltage tests. Refer to Fax #1.

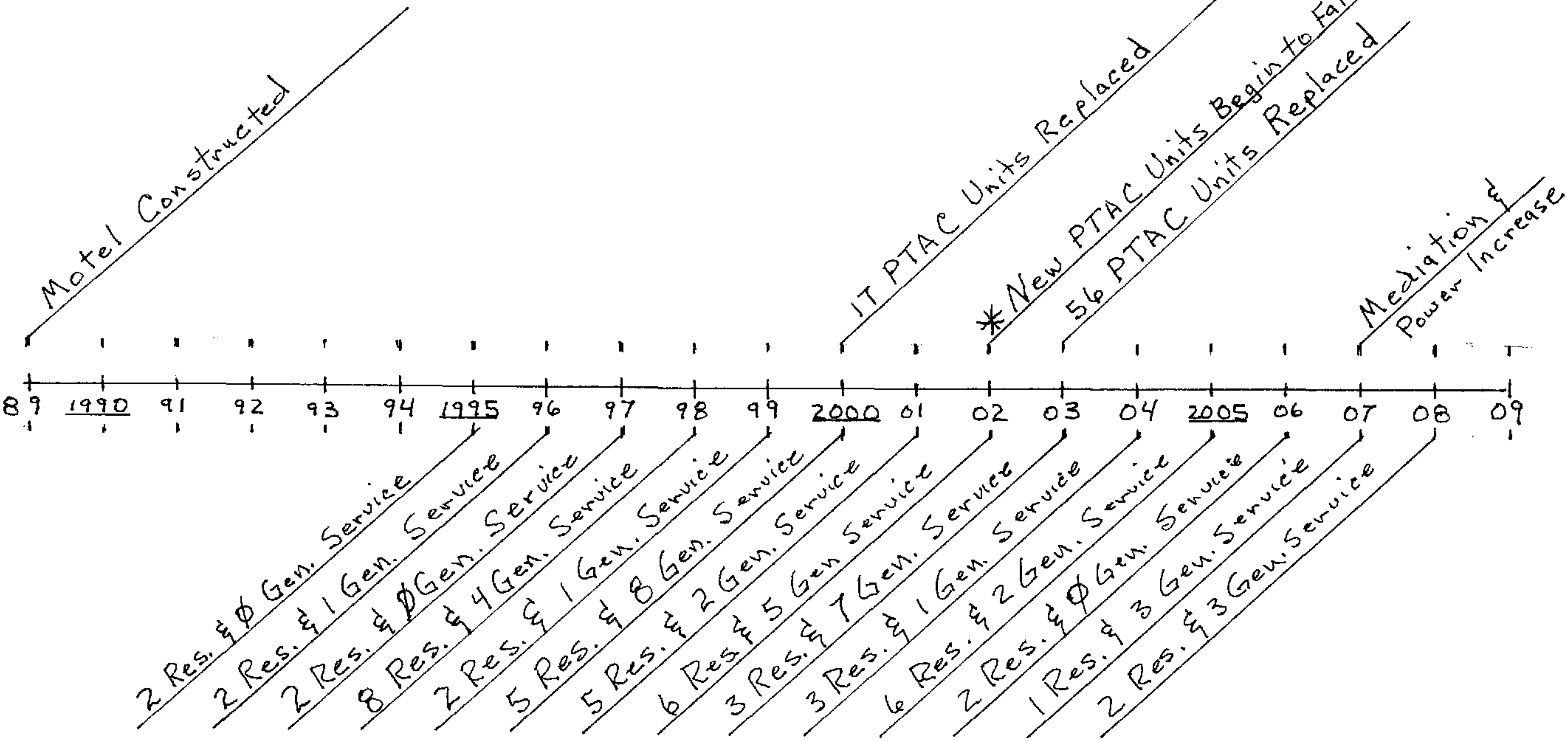
07/06/06-A conference call was done between Mr. Wheeler, Angela Allison (APS) and John La Porta. Mr. Wheeler is going to have an his engineer go over the readings which APS provided. This is suppose to be done tomorrow. He will contact me again, when he has more information. Mr. Wheeler is still requesting APS' initial report which the company states was incomplete. He feels the company is hiding something.

07/10/06-Angela Allison called to say that she is faxing over the customer's first reads regarding this issue, which reflects that the test was incomplete. Refer to Fax #2.

07/11/06-I left a voice-mail message for the customer; asking for a return call.

ATCH #24

TIME LINE COMPARING INCREASED POWER DEMAND WITH PTAC UNIT REPLACEMENT



86 Residential & General Service Meters Added to Feeder #22